FINAL
CORRECTIVE MEASURES STUDY WORK PLAN
for
SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33; and AOCs 1, 4, and 8
AK STEEL
KANSAS CITY, MISSOURI

USEPA ID# MOD007118029

September 2012

Prepared for

AK Steel

By

RCRA

520599

Burns & McDonnell Project No. 67873
Burns & McDonnell Engineering Company
Kansas City, Missouri

AK Steel Corporation
Environmental Affairs
9227 Centre Pointe Drive
West Chester, Ohio 45069

September 17, 2012

Bruce Morrison, Project Manager
Waste Remediation and Permitting Branch
Air and Waste Management Division
United States Environmental Protection Agency - Region VII
901 North 5th Street
Kansas City, KS 66101

Re: HSWA Corrective Action Permit Number MOD 007 118 029
Final Corrective Measures Study Work Plan for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 14, and 33; and AOCs 1, 4, and 8
AK Steel, Kansas City, Missouri

Dear Mr. Morrison:

AK Steel is submitting to the United States Environmental Protection Agency (USEPA) and the Missouri Department of Natural Resources (MDNR) the *Final Corrective Measures Study Work Plan for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 14, and 33; and AOCs 1, 4, and 8,* which was prepared by Burns & McDonnell Engineering Company, Inc. (BMcD) at our direction. This report is in response to USEPA's August 27, 2012 "Approval of Response to Comments on the Draft Corrective Measures Study (CMS) Work Plan." Comments were incorporated as outlined below:

Comment	Response Location
Comment #1	Table 2-1 was split into separate tables for the soil screening west of I-435 (Table 2-1) and soil screening east of I-435 (Table 2-2). The USEPA Regional Screening Level (RSL) for residential soil was incorporated into these tables.
Comment #2	Table 2-1 was split into separate tables for the soil screening west of I-435 (Table 2-1) and soil screening east of I-435 (Table 2-2). The USEPA Region 5 ecological soil screening levels were incorporated into Table 2-2.
Comment #3	Table 2-1 was revised to include screening levels for elemental mercury.
Comment #4	The introductory paragraph for Section 2.2 was revised to indicate that the screening process does not apply to SWMUs 2, 3, and 5 where solid waste remains on site in capped landfills.
Comment #5	Section 2.2.1 was revised to include subsections for soil screening applicable to areas West of I-435 and East of I-435.
Comment #6	Section 2.2.2 was revised to include evaluation of cumulative effects to the groundwater screening process. Table 2-2 was updated to Table 2-3 to reflect changes to the soil screening tables noted previously.

Comment	Response Location
Comment #7	Section 2.3 SWMU and AOC Investigation Summary and Preliminary Screening and associated appendices were removed from the CMS Work Plan. The remaining subsections within Section 2 were renumbered accordingly.
Comment #8	Section 2.4 (Section 2.3 after revision) was revised to reflect changes to the preliminary media cleanup standards consistent with data screening changes in Sections 2.2.1 and 2.2.2.
Comment #9	Section 2.5 (Section 2.4 after revision) was revised to indicate that the points of compliance for contamination within groundwater are expected to be the downgradient boundary of the SWMU or AOC.

CERTIFICATION:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

This Report and Certification are submitted on behalf of AK Steel Corporation.

Very truly yours,

James C. Levengood
Corporate Manager of Environmental Affairs

cc: B. Morrison – USEPA Region 7 (2 Copies)
C. Kump-Mitchell – MDNR (1 Copy)
B. Stuart – MDNR (2 Copies)
C. Batliner – AK Steel
S. L. Shelton – Burns & McDonnell

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Burns & McDonnell Project No. 67873
Burns & McDonnell Engineering Company
Engineers-Architects-Consultants
Kansas City, Missouri

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LIST OF ACRONYMS

American	American Properties, LLP
AOC	area of concern
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
BMcD	Burns & McDonnell Engineering Company, Inc.
BMWCI	Burns & McDonnell Waste Consultants, Inc.
CAO	Corrective Action Objective
CCB	Compass Big Blue, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienist
CFR	Code of Federal Regulations
CMS	Corrective Measure Study
DCE	dichloroethene
DPE	Dual Phase Extraction
Facility	AK Steel, 7000 Winner Road, Kansas City, Missouri
GST	GST Technologies Operating Co., Inc.
Hansen	Hansen Property Development, Inc.
HASP	Health and Safety Plan
HSM	Health and Safety Manager
HSWA	Hazardous and Solid Waste Amendments
I-435	Interstate 435
KCT	Kansas City Terminal Railway Company
LLC	Limited Liability Company
LTM	long term monitoring
MCL	maximum contaminant level
MDNR	Missouri Department of Natural Resources
mg/kg	milligrams per kilogram
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PE	Professional Engineer
Permit	HSWA Part B Post Closure Permit
PG	Professional Geologist
pH	hydrogen ion potential
PRG	Preliminary Remediation Goal

LIST OF ACRONYMS (continued)

RCRA	Resource Conservation and Recovery Act
RCRA Landfill	Emission Control Dust Landfill
RFI	RCRA Facility Investigation
RSL	Regional Screening Level
SHSS	Site Health and Safety Supervisor
SVOC	semivolatile organic compound
SVE	Soil Vapor Extraction
SWMU	Solid Waste Management Unit
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WCC	Woodward-Clyde Consultants

DOCUMENT DISTRIBUTION

USEPA Region 7, Bruce Morrison, Project Manager – 2 copies

Missouri Department of Natural Resources, Christine Kump-Mitchell, Project Manager – 1 copy

Missouri Department of Natural Resources, Bruce Stuart, Sr. Technical Advisor – 2 copies

AK Steel, Cory Levengood – 1 copy

AK Steel, Carl Batliner – 1 copy

Burns & McDonnell Engineering Company, Inc., Sharon Shelton – 2 copies

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1.0 INTRODUCTION

Burns & McDonnell Engineering Company, Inc. (BMcD) has prepared this Corrective Measures Study (CMS) Work Plan on behalf of AK Steel (former Armco Inc.[1]) to describe the general approach for determining areas that require active remediation, defining corrective action objectives, and investigating/evaluating potential remedies. AK Steel previously conducted a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and a Supplemental Investigation at the AK Steel Facility, Kansas City, Missouri (Facility) to satisfy the "Special Permit Conditions" presented in Part II of AK Steel's Hazardous and Solid Waste Amendments (HSWA) Part B Post-Closure Permit (Permit), which was issued by the United States Environmental Protection Agency (USEPA) Region 7 on November 30, 1994 (USEPA ID# MOD 007118029). The results of these investigations were summarized in the *RCRA Facility Investigation Report, Armco Kansas City Facility* (RFI Report) (Burns & McDonnell Waste Consultants, Inc. [BMWCI], 1999) and *Supplemental Investigation Report, AK Steel, Kansas City, Missouri* (BMcD, 2008). The USEPA and Missouri Department of Natural Resources (MDNR) have approved both of these documents in combination to satisfy Special Permit Condition XXX presented in Part II of the Permit.

1.1 PURPOSE AND SCOPE

In accordance with Section XXXII of Part II of the Permit and in response to USEPA's April 12, 2012 "Notice to Conduct a Corrective Measures Study," AK Steel is submitting this CMS Work Plan for Solid Waste Management Units (SWMUs) 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33; and Areas of Concern (AOCs) 1, 4, and 8. This document describes the general approach for determining areas that require active remediation, defining corrective action objectives, and investigating/evaluating potential remedies. It also describes remedies preliminarily identified for evaluation during the CMS. As defined in the "Notice to Conduct a Corrective Measures Study," the scope of this report includes the following SWMUs and AOCs that are located on AK Steel property:

- SWMU 2 – Old Blue River "W" Landfill
- SWMU 3 – South of Bar Fab Landfill

[1] Effective September 30, 1999, Armco Inc. was merged with and into AK Steel Corporation, a Delaware Corporation with headquarters in West Chester, Ohio.

- SWMU 4 – 1987 Waste Pile
- SWMU 5 – Plant Rubble Landfill
- SWMU 6 – RCRA Permitted Baghouse Dust Tanks
- SWMU 7 – No. 1 Melt Shop Baghouse Dust Tanks
- SWMU 12 – AMOCO Landfarm
- SWMU 13 – Pickle Liquor Tanks
- SWMU17 – Wire Mill Rinsewater Neutralization Tank
- SWMU 24 – Waste Hydraulic Lubricating Oil Storage Tanks
- SWMU 33 – Nail Mill Degreasing Area
- AOC 1 – Abandoned Fuel Oil Storage Tank
- AOC 4 – Boiler Furnace Area
- AOC 8 – "Owl Gun Club" Shooting Park

1.2 FACILITY BACKGROUND

1.2.1 Facility Location

Figure 1-1 presents a Facility Location Map. The Facility is located in northeast Kansas City, Missouri within the Blue River and Missouri River floodplains. Portions of the Facility are located both east and west of Interstate Highway 435 (I-435). Industrial activities were performed exclusively in the area west of I-435, north of 12th Street, and east of Ewing Avenue. Figure 1-2 depicts the Facility, and presents ownership and operational changes that have occurred since issuance of the Permit. The current address for the AK Steel Kansas City Facility is:

AK Steel
7000 Winner Road
Kansas City, Missouri 64125

1.2.2 Facility History

The Kansas City Bolt and Nut Company first occupied the area in 1888. This company manufactured iron bolts and nuts from purchased iron until the early 1920s when open-hearth furnaces were installed. After that time, the company pioneered the production of carbon steel products from 100-percent recycled scrap iron and steel. The company's name was changed in 1925 from the Kansas City Bolt and Nut Company to Sheffield Steel Corporation, and the company became a subsidiary of Armco Steel Corporation in 1930.

In 1951, Armco completed construction of the No. 1 Melt Shop, which produced steel from 100 percent scrap using electric arc furnace technology. Additional electric arc furnaces were installed in the No. 1

Melt Shop in the mid 1950s and early to late 1960s, for a total of four electric arc furnaces. In 1959, production of steel in open-hearth furnaces was discontinued, and the open-hearth furnaces were later demolished.

Steel ingots produced in both open-hearth and electric arc furnaces were rolled in the 32” Blooming Mill and 18" Rolling Mill to produce billets that were primarily used as feed stock for other plant operations. The 12" Merchant Bar Mill was built and began production in the early 1950s to supplement the 10" Finishing Mill. In 1957, the Rod Mill was built and placed in operation.

A second melt shop complex was built and placed in operation in 1976. The complex included the No. 2 Melt Shop (with two additional electric arc furnaces), a continuous caster, and a 19" Rolling Mill. By 1977, Armco's Kansas City steel production operations included six electric arc furnaces in two melt shops, a blooming mill, and a continuous caster. A multitude of semi-finished and finished products were produced by the 19" Rolling Mill, the 12" Finishing Mill, the Rod Mill, the Wire Mill, the Nail Mill, the Bolt and Nut Plant, and the Grinding Media Facility. A ladle arc refining facility was added to the No. 2 Melt Shop operation in 1989. Economic conditions in the steel industry affected Armco’s Kansas City plant, and the diversity of operations was slowly reduced.

By 1993, Armco’s Kansas City plant had continued to grow in production tonnage, but production was limited to semi-finished steel products and a minor amount of finished steel products. Historically, the plant operations and property owned by Armco (now AK Steel) totaled approximately 860 acres. Production facilities and a portion of the plant real estate were sold to GST Technologies Operating Company, Inc. (GST), which was doing business as GST Steel Company, on November 12, 1993. Armco retained ownership of approximately 560 acres, of which GST leased approximately 100 acres. GST operated facilities on this property until they filed for bankruptcy in April 2001. There are no active manufacturing operations or activities on the AK Steel property. As part of the bankruptcy proceedings, GST sold the majority of their holdings to Compass Big Blue LLC (CBB).

In the intervening years, the CBB tracts have been sold to House of Burgesses LLC, CTE Properties LLC, Smorgon Steel Grinding Systems LLC[2], Blue Summit LLC, and/or Mile Rail LLC. Businesses currently operating on these former CBB parcels include:

[2] Smorgon Steel Grinding Systems LLC merged with OneSteel Limited in August 2007. Moly-Cop Grinding Media, a division of OneSteel, currently operates this parcel.

- A large metal scrapping operation, Midwest Scrap Management, has been situated on the property owned by House of Burgesses LLC.
- A truck and equipment sales and rental company is present on the CTE Properties LLC parcel.
- A steel grinding ball manufacturing operation is present on the parcel owned by OneSteel, and it is currently doing business as Moly-Cop.
- An environmental and rail service company, specializing in rail car cleaning and maintenance, is located on the Mile Rail, LLC parcel.
- Blue Summit LLC appears to be operating a mill scale excavation and beneficial reuse business on its parcel.

Additionally, approximately 20 acres of GST's property were sold to American Properties LLP (American) during the bankruptcy proceedings, and this property has subsequently been sold to Hansen Property Development, Inc. (Hansen). A U-Pick-It salvage yard currently operates on the Hansen parcel. The ownership and operation of these former GST tracts are now the responsibility of Hansen, House of Burgesses LLC, CTE Properties LLC, OneSteel, Mile Rail LLC, and/or Blue Summit LLC; however, certain SWMUs and AOCs are listed in AK Steel's Permit for purposes of RCRA Corrective Action. The property ownership and operational changes since the initial permit application and issuance are shown on Figures 1-2 and 1-3.

1.2.3 RCRA Permit History

From July 1980 through January 25, 1983, an Emission Control Dust Landfill (RCRA Landfill) was operated by Armco at the Facility. During this period the landfill received approximately 29,190 tons (36,000 cubic yards) of hazardous waste identified by waste code K061. The waste, which was generated by melting scrap iron and steel in the plant's six electric arc furnaces, was collected in baghouse air pollution control systems and transported to the landfill for disposal. The landfill was certified as closed on September 19, 1984. Management of this closed landfill is outlined in AK Steel's Permit. Part I is the final RCRA Hazardous Waste Facility Post-Closure Permit issued by the MDNR with an effective date of February 16, 1994. Part II is the HSWA Corrective Action Permit issued by the USEPA Region VII with an effective date of December 1, 1994.

1.2.4 Environmental Setting

The environmental setting for the Facility was previously described in Section 2 of the RFI Report (BMWCI, 1999).

1.3 CMS WORK PLAN ORGANIZATION

This CMS has been prepared by BMcD and consists of one volume. This document is organized as follows:

- Section 1.0 – Introduction
- Section 2.0 – CMS Objectives
- Section 3.0 – CMS Alternatives
- Section 4.0 – Evaluation of Corrective Measures
- Section 5.0 – Pilot, Laboratory, and/or Bench Scale Studies
- Section 6.0 – CMS Report Outline
- Section 7.0 – Project Management
- Section 8.0 – References
- Tables
- Figures

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2.0 CMS OBJECTIVES

The overall objective of the CMS is to mitigate potential current and future risks to human health and the environment. The following section provides relevant background information for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33 and AOCs 1, 4, and 8; discussion of the screening process that will be used to determine the need for additional remediation at a SWMU or AOC; a preliminary comparison of SWMU and AOC investigation data to the screening levels; and, a description of the process that will be used to establish media cleanup standards and points of compliance.

2.1 HISTORY OF SWMUS AND AOCS INCLUDED IN THE CMS

2.1.1 SWMUs/AOCs on Property East of I-435

2.1.1.1 SWMU 2 – Old Blue River "W" Landfill

The Old Blue River "W" Landfill (SWMU 2) is a closed landfill previously used to manage emission control dust and solid waste. This W-shaped portion of the Old Blue River channel was used to dispose of emission control dust generated in the No. 1 and No. 2 Melt Shop electric arc furnaces from approximately 1965 until 1980. In addition, general plant and office trash was disposed in this SWMU. SWMU 2 covers an area of approximately 7 acres and is estimated to contain 185,000 cubic yards of material. The landfill was closed through construction of a soil cap (approximately three feet of compacted soil and a vegetative (fescue grass) cover. SWMU 2 is regularly mowed and inspected as a closed landfill. This site has been classified as a Class 4 Site on the Missouri Registry of Confirmed Abandoned or Uncontrolled Sites. Class 4 is defined as "sites that have been previously closed and require continued management" (MDNR, 2011).

2.1.1.2 SWMU 4 – 1987 Waste Pile

The 1987 Waste Pile (SWMU 4) consisted of a pile of emission control dust that was discovered in 1987 near the Old Blue River "W" Landfill (SWMU 2). The estimated quantity of emission control dust (i.e., K061 dust) in the waste pile was 14,000 cubic yards. It is not known how long the pile was in existence. In 1988, the waste pile was transported off site for reclamation and manifested as emission control dust. The original defined SWMU area was approximately 1.5 acres in size; however, during the RFI, the soil contamination in the SWMU 4 area expanded in size to the west and south to encompass nearly 16 acres.

2.1.1.3 SWMU 5 – Plant Rubble Landfill

The Plant Rubble Landfill (SWMU 5) is a landfill which was used by Armco from 1980 to 1993 to manage rubble and demolition materials. The landfill was capped and subsequently vegetated (fescue grass). The vast majority of the landfill contents are construction debris, including: concrete, sand, earth, rock, etc. SWMU 5 covers an area of less than 3 acres and is located immediately south of the permitted RCRA Landfill. The volume of materials contained in the landfill is estimated at 120,000 cubic yards.

2.1.1.4 SWMU 12 – AMOCO Landfarm

SWMU 12 (see Figure 1-2) is located on AK Steel property that was leased to Amoco from December 1973 through September 1980, and this area was used by Amoco from 1975 through 1979 for the landfarming of petroleum refining waste generated at the Amoco Sugar Creek Refinery. SWMU 12 covers approximately 10 acres.

Amoco hauled petroleum refining waste to SWMU 12 by truck from the refinery which is located east of SWMU 12 in Sugar Creek, Missouri. The waste was incorporated into the soil by surface spreading and discing. Based upon information provided by Amoco, approximately 30,000 tons of petroleum refining waste was placed in SWMU 12 during its five years of operation. It has been estimated that 3 to 8 inches of petroleum refining waste were incorporated into the soil each year (Woodward-Clyde Consultants [WCC], 1980). An estimated total of 24 inches of waste, having a wet weight of 30,000 tons and a dry weight of 15,000 tons, was managed at SWMU 12. Water decanted from the sludge material and precipitation falling on the SWMU was controlled by a dike that surrounds the SWMU. Two culverts were located through the dike so that surface water could be discharged from the area, as necessary. No information is available regarding the quality or quantity of water discharged from SWMU 12 during operation. The culvert gates appeared to be closed during a visit by Armco and BMWCI personnel to the SWMU in early 1995; however, one of the culverts had been silted in and was not visible from the ground surface.

The only known waste activity conducted by Armco at SWMU 12 involved a one-time land application of liquid and sludge sediment generated during the cleaning of a No. 2 fuel oil tank. This activity is believed to have taken place in 1976 or 1977. Although the exact quantity of material associated with this activity cannot be determined, it is anticipated that the quantity was less than the capacity of the 10,000 gallon No. 2 fuel oil tank, because the product was removed from the tank long before this activity took place. The material transported to SWMU 12 was limited to the residual material remaining at the bottom of the tank. The material was transported to SWMU 12 in a single trip by a vacuum truck. Although the actual quantity of material is unknown, it is not anticipated to have exceeded a few hundred gallons.

In a 103(c) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) notification to USEPA, Amoco classified the materials disposed in SWMU 12 under hazardous waste codes K048, K049, K050, and K051 (Helffrich, 1981). The basis for the listing of these waste codes is the presence of lead and hexavalent chromium. At the time that the petroleum refining waste was managed at SWMU 12, it was not classified as hazardous waste. Samples taken from sludge-incorporated soil passed the EP-Toxicity testing for chromium and lead (WCC, 1980).

In November 1998, Armco personnel observed deterioration of the dike located around SWMU 12. Armco and BMWCI personnel performed an engineering evaluation of the dike failure. A slope failure occurred on the southern portion of the dike, directly north of the relocated Rock Creek and the Independence Sewage Treatment Plant outfall location. The failure was approximately 140 feet long and extended back into the bank approximately 40 feet from the toe of the slope at its deepest point. It appeared that the failure was a result of extensive erosion on the supporting toe of the slope and scouring of the dike due to Rock Creek flow combined with discharge from the Sewage Treatment Plant outfall. Based on the site evaluation, it did not appear that contents of the SWMU were released due to this condition. USEPA was notified of these conditions in Armco's Fourth Quarter 1998 Progress Report dated January 11, 1999. ThermoRetec Corporation completed repairs to the levee in November 1999.

SWMU 12 is currently heavily vegetated with various brush and trees. A portion of SWMU 12 in is the right-of-way for a planned roadway, the Lewis and Clark Expressway. The conceptual design for this roadway has been completed.

2.1.1.5 AOC 8 – "Owl Gun Club" Shooting Park

AOC 8 (see Figure 1-2), was a clay pigeon shooting park known as the "Owl Gun Club" which was located south of the Old Blue River "W" Landfill (SWMU 2) and immediately north of Rock Creek. The specific dates of operation of the Owl Gun Club are unknown. From a review of aerial photos, the AOC first becomes visible in 1955 and is no longer visible in 1974. Prior to use of the shooting range, the area was used for agriculture. Stationing posts and two trap buildings are visible on a 1955 aerial photograph. The western trap building is no longer present by 1964. By 1974, all evidence of the shooting range has been removed, and the area was again used for agriculture. Because little information is available about the dates the gun club was active or the amount of activity at the club, it is not possible to estimate how much lead shot might be present. The original defined AOC area was approximately 2.5 acres in size. During the RFI, the AOC 8 area expanded in size, primarily to the north, to approximately 6 acres.

2.1.2 SWMUs/AOCs South of 24 Highway

2.1.2.1 SWMU 3 – South of Bar Fab Landfill

The South of Bar Fab Landfill (SWMU 3) is located partially on AK Steel property (see Figure 1 2) and partially on property owned by the City of Kansas City, Missouri. SWMU 3 is a closed landfill that was previously used to manage emission control dust and various solid waste materials. SWMU 3, which covers an area of just over 1 acre, was closed in 1980 through construction of a soil cap (approximately three feet of compacted soil) and a vegetative cover (fescue grass). A portion of the area in the general vicinity of the SWMU, including a portion of the landfill itself, was deeded to the City in 1983 for completion of channelization work on the adjacent Blue River. The cap was subsequently upgraded on the western side of the landfill to a concrete cover, which was also extended across a drainage culvert located along the northern edge of the landfill. In the spring of 1998, modifications were made in the SWMU 3 area when a paved access road was constructed over the top of the closed landfill. The landfill encompasses approximately 44,000 square feet and has a maximum thickness of 17 feet. Total volume of the landfill was estimated to be 14,000 cubic yards (Remcor, 1988).

2.1.2.2 SWMU 7 – No. 1 Melt Shop Baghouse Dust Tanks

The No. 1 Melt Shop Baghouse Dust Tanks (SWMU 7) consisted of two former tanks used for temporary storage of emission control dust. The total storage capacity of the tanks was approximately 75 cubic yards. Prior to their demolition in 1991, the tanks were cleaned by a remediation contractor, and emission control dust was removed from dust handling equipment. Only the foundations of the No. 1 Melt Shop remain. The original defined SWMU area was approximately 50 feet by 25 feet. During the RFI, SWMU 7 expanded in size west and south of the former tanks to approximately 2 acres.

2.1.3 AOC 1 – Abandoned Fuel Oil Storage Tank

<u>AOC Background</u>

The Abandoned Fuel Oil Storage Tank (AOC 1) consisted of a single aboveground storage tank (AST) that was used for the storage of heating oil. Oil was delivered to the oil platform by railcar, and aboveground piping was used for fuel transfer. The tank was installed in 1951 and had a capacity of 840,000 gallons. It was located north of U.S. Highway 24 (Independence Avenue) and east of the Big Blue River. From 1951 until 1962 it was used for the storage of No. 6 fuel oil. Beginning in 1962, and continuing until 1982, the tank was used for the storage of No. 2 fuel oil. The tank was removed from service in 1982, and was cleaned and removed in 1991. During its operation, the tank was surrounded by a containment dike. The defined AOC area was approximately 1.5 acres in size.

In October 1998, an oil sheen on the adjacent Blue River was traced to this location. The sheen was discovered by United States Army Corps of Engineers (USACE) personnel who were working along the river. Investigation activities were undertaken to determine the condition of the AST area and to determine if petroleum contamination was present between the tank site and the river. From November 1988 through January 1989, the USACE collected soil samples from the eastern bank of the Big Blue River. In 1988 and 1989, soil samples collected by the USACE had total recoverable petroleum hydrocarbons (TRPH) ranging from 38 to 728 milligrams per kilogram (mg/kg) and oil and grease ranging from 76 to 9,505 mg/kg. Polychlorinated biphenyls (PCBs) were not detected (< 1 mg/kg), and VOCs were not detected (< 1 mg/kg) except for one sample that had a total volatile organic compound (VOC) concentration of 12.5 mg/kg (Remcor, 1989).

A Preliminary Site Investigation completed in 1989 by Remcor indicated the following:

- Borings drilled in the oil unloading platform encountered mill scale fill overlying aggregate fill overlying alluvium. The mill scale fill had oil and grease concentrations less than 1,000 mg/kg. Oil and grease concentrations in the aggregate fill ranged from 53 to 7,700 mg/kg. One soil sample was collected from the alluvium and contained 53 mg/kg oil and grease.

- Borings drilled in the river bank were logged as aggregate fill over alluvium. Free product was observed on the water table in this area. Remcor concluded that the source for the petroleum hydrocarbons was the oil unloading platform area. Soil samples had oil and grease concentrations ranging from nondetect to 4,300 mg/kg.

Based upon the investigation, a recovery well, two observation wells, and one observation piezometer were installed at the site. Armco began recovering petroleum hydrocarbons and water from the recovery well in 1991. Recovery activities ceased in the fall of 1991 because petroleum hydrocarbons were no longer present in the wells (Remcor, 1991).

2.1.4 SWMUs/AOCs at the Former Tank Farm

The former Tank Farm is located directly north of the Kansas City Terminal Railway Company (KCT) Railroad flyover bridge on the east side of the Blue River. SWMU 6, AOC 4, and SWMU 24 are located adjacent to each other in this area. SWMU 6 includes the area surrounding the locations of former Tanks 1, 2, 3, and 5, and AOC 4 includes the area surrounding former Tank 4. SWMU 24 was located in a depression between Tanks 2 and 3. Due to their proximity, they are presented together in this section for ease of understanding. The combined area of SWMU 6, AOC 4, and SWMU 24 is approximately 4 acres.

2.1.4.1 SWMU 6 – RCRA Permitted Baghouse Dust Tanks

SWMU Background

The RCRA Permitted Baghouse Dust Storage Tanks (SWMU 6) were four ASTs, known as Tanks 1, 2, 3, and 5. The ASTs were originally constructed for fuel oil storage, but were later used to store emission control dust. Tanks 2, 3, and 5 were approximately 100 feet in diameter with a height of approximately 40 feet, and each had a capacity of approximately 2,350,000 gallons. Tank 1 was approximately 100 feet in diameter with a height of 30 feet and had a capacity of approximately 1,750,000 gallons.

During their use for fuel oil storage, the ASTs stored No. 2 and No. 6 fuel oil. A central aboveground pipeline connected each of the tanks with the pumphouse which was located south of Tanks 1 and 2. Tanks 1, 2, and 3 were installed sometime between 1947 and 1953, and Tank 5 was installed in 1975. At some point, a new pumphouse was installed to the northwest of Tank 3 to replace the old pumphouse. The old pumphouse was cleaned in 1994 and removed in 1997/1998. The new pumphouse was demolished along with the tanks in 1998.

In January of 1983, landfill closure activities began at the RCRA Landfill, and the emission control dust generated at the No. 1 and No. 2 Melt Shops began being stored in the ASTs at SWMU 6. A hazardous waste permit issued to Armco in February 1985 allowed the storage of K061 waste (i.e., emission control dust) in these ASTs. On July 15, 1986, Armco ceased adding K061 to the tanks. Between 1987 and June 1991, the tanks were emptied and emission control dust was transported off site for reclamation utilizing the Dust Railcar Loading Area – Bar Joist Building (SWMU 10). On November 19, 1990, certifications of closure were submitted to MDNR for Tanks 3 and 5, and on August 2, 1991, certifications of closure were submitted to MDNR for Tanks 1 and 2. The ASTs were not used for any other purpose after they were cleaned and closed. The hazardous waste permit expired in February 1992. A renewal application for a hazardous waste permit was submitted in January 1992 but was subsequently withdrawn.

As part of the closure activities, emission control dust was removed from the tanks and the interior walls were vacuumed. A high-powered wash followed the vacuum procedure. Post-cleaning wipe samples were collected and analyzed for cadmium. Results of this analysis for the tanks and limited adjacent soil sampling are provided in Appendix A to the RFI Workplan (BMWCI, 1996).

2.1.4.2 AOC 4 – Boiler Furnace Area

The Boiler Furnace Area (AOC 4) is an area that previously contained boilers that were supplied with natural gas supplemented by on-site fuel oil. In the past, fuel oil burned in the boilers was supplied from Tank 4 at the Tank Farm and transported by aboveground piping to the Boiler Furnace Area. During this time, waste oil accumulated at SWMU 24 and was pumped to Tank No. 4 for inclusion in the fuel oil. This practice was performed until 1991 when Armco began transporting waste oil off site for fuel blending. In 1993, the boilers were shut down and the transfer of fuel oil from Tank 4 to the boiler house ceased. The associated equipment was thoroughly cleaned in 1994.

Various records indicate that for a brief time in the 1980s, 1,1,1-trichloroethane (1,1,1-TCA) may have been mixed into the waste oil and subsequently mixed with the fuel oil and utilized in the boiler furnaces. Since there was no mechanism at the boiler furnaces to incorporate the addition of any material to the fuel oil supply, AOC 4 was defined as Tank No. 4, which is where waste oil would have been added into the fuel oil that supplied the boiler furnaces.

2.1.4.3 SWMU 24 – Waste Hydraulic Lubricating Oil Storage Tanks

The former Waste Hydraulic and Lubricating Oil Storage Tanks (SWMU 24), located on AK Steel and KCT property (Figure 1-2), functioned between 1975 and 1993 as a waste oil collection system for the entire Facility. Waste oil of various types was brought to the area in drummed containers or 600-gallon waste oil “tote boxes”. Until 1991, the waste oil from SWMU 24 was incorporated into the heating oil supply; however, after November 1991, waste oil was sent off site for fuel blending. The defined SWMU area was approximately 1 acre in size.

When the SWMU was removed from service in 1993, its components were cleaned and subsequently dismantled and removed. The two ASTs at SWMU 24 were cut up and recycled in 1996. Various records indicated that for a brief time in the 1980s, 1,1,1-TCA might have been mixed into the waste oil, which was subsequently mixed with the fuel oil and utilized in the boiler furnaces (AOC 4). There was no mechanism at the Boiler Furnace Area to incorporate the addition of any material to the fuel oil supply. If 1,1,1-TCA was added to the fuel oil system, it most likely would have been added in the waste oil area.

As reported to USEPA and MDNR in a letter dated March 9, 1999, Armco sold a portion of its property, totaling less than one (1) acre, to KCT for construction of an overhead Railroad Bridge known as the Flyover Project to relieve transportation congestion and public safety issues in the area. This parcel of land contained a portion of SWMU 24. As part of the Flyover Project, the low-lying area at the center of SWMU 24 was partially filled by KCT.

2.1.5 SWMUs Associated with Nail Mill Degreaser VOC Plume

Prior to the RFI, historical investigations indicated the presence of a chlorinated VOC plume that centered on the former Nail Mill degreaser (SWMU 33). During the RFI, it became apparent that the chlorinated

VOC plume radiated outward from this area and a monitoring well network was installed across a broad area that included both SWMU 13 (Pickle Liquor Tanks) and SWMU 17 (Wire Mill Rinsewater Neutralization Tank). For this reason, much of the groundwater discussion related to geology, hydrogeology, and groundwater flow direction is presented on an area-wide basis that includes the following SWMUs:

- SWMU 13 – Pickle Liquor Tanks
- SWMU 17 – Wire Mill Rinsewater Neutralization Tank
- SWMU 33 – Nail Mill Degreasing Area

This area is located west and south of a bend in the Blue River. The paved, channelized portion of the Blue River channel is adjacent to the SWMU 13/17/33 area. In this area the total depth from the top of slope to the bottom of the low flow channel is approximately 30 feet.

2.1.5.1 SWMU 13 – Pickle Liquor Tanks

The pickle liquor tanks (SWMU 13) were operated from May of 1971 to 1989 and were removed in 1992. As part of the steel rod cleaning operation, sulfuric acid was used to clean iron oxide from steel rods prior to the production of nails, fence, and wire. The term used to describe this process is pickling, and the waste sulfuric acid generated by these pickling activities is referred to as spent pickle liquor.

In 1980, spent pickle liquor became a RCRA-listed hazardous waste with the waste code K062. Prior to 1981, the spent pickle liquor accumulated at this SWMU was sent off site for treatment and disposal. In 1981, Armco installed a recycling system for the spent pickle liquor that remained in use until 1989 when the steel rod cleaning operation ceased and the Cleaning House closed.

Spent pickle liquor was stored in three tanks at different times during the operational life of SWMU 13. These tanks were of varying capacities and dimensions and were located on the east side of the Cleaning House, also known as the Rod Cleaning Building. The spent pickle liquor was transferred from brick-lined acid tubs in the production line by means of overhead piping. Regeneration was accomplished by cooling the spent pickle liquor in a 3,000-gallon, rubber-lined, steel, above ground cooling tank located adjacent to the AST. The cooling caused ferrous sulfate heptahydrate to precipitate from the spent pickle liquor. From the cooling system, regenerated acid was returned to the tubs in the production line. The ferrous sulfate heptahydrate precipitate was sold to chemical supply companies for a number of uses. The most significant use was as a wastewater treatment chemical. The amount of spent pickle liquor generated during cleaning activities varied with the amount of rod cleaned.

The defined SWMU 13 area is less than 0.1 acre in size. In August 1998, modifications were made in the vicinity of SWMU 13 as Armco extended Wilson Avenue in an east-west direction. As part of this modification, various concrete basement walls near SWMU 13 were lowered below grade. The concrete from the walls and other imported aggregate materials were used to fill any voids in the subsurface. At present, the surface materials consist of slag, other aggregate, and the remnants of building foundations. There is no surface soil, per se, at this location.

2.1.5.2 SWMU 17 – Wire Mill Rinsewater Neutralization Tank

The Wire Mill Rinsewater Neutralization Tank (SWMU 17) consisted of an open-topped 18,000-gallon concrete in ground storage tank (UST) with an acid-proof brick lining. During its operation, the tank received acid rinse waters from the hydrochloric acid wire cleaning operations and the sulfuric acid rod cleaning operations. The SWMU 17 tank was cleaned and closed in place in 1991 as part of the closure activities at the Wire Mill. The defined SWMU area is approximately 50 feet by 80 feet. In August 1998, modifications were made in the area as Wilson Avenue was extended in an east-west direction across the west of SWMU 17. As part of this modification, the concrete walls of SWMU 17 were lowered, and the concrete from the walls and other imported aggregate materials were used to fill the void left by the former tank. At present, the surface materials consist of slag, other aggregate, and the remnants of building foundations. There is no surface soil, per se, at this location.

2.1.5.3 SWMU 33 – Nail Mill Degreasing Area

The Nail Mill Degreasing Area (SWMU 33) was used for the removal of residue during the production of nails. The degreasing operation was located in the northwest portion of the Nail Mill. The presence of chlorinated VOCs in the surrounding area was discovered and reported in 1991 while Armco was preparing for the closure and conversion of the mill into a warehouse. The nail mill was subsequently demolished and a wood block floor contaminated with trichloroethene (TCE) was removed and properly disposed. The Nail Mill Degreasing Area (SWMU 33) currently consists of rubble over the concrete floor of the former building. The defined SWMU 33 area is approximately 2.5 acres in size. At present, the surface materials consist of slag, other aggregate, and the remnants of concrete building foundations. There is no surface soil, per se, at this location.

2.2 PROPOSED SWMU AND AOC SCREENING PROCESS

A screening process was developed to determine the need for a particular SWMU or AOC to be carried forward as part of the CMS. This screening process does not apply to SWMUs 2, 3, and 5 where solid wastes remain in place within capped landfills. With these exceptions, screening will be conducted for both soil and groundwater as described in the following sections.

2.2.1 Soil Screening Process

The screening criteria for soil are presented on Tables 2-1 and 2-2. These tables present screening levels for constituents that have been detected in soil samples at the Facility. As presented in the following sections, soil screening will be performed based upon the location of SWMU or AOC at the Facility.

2.2.1.1 SWMUs and AOCs West of I-435

Manufacturing activities were performed in the area west of I-435, north of 12th Street, and east of Ewing Avenue. Soil screening will be performed for the following SWMUs and AOCs within the former manufacturing area: SWMUs 6, 7, 13, 17, 24, and 33, and AOCs 1 and 4. The screening levels for this area are presented on Table 2-1 and were based on the following conventions:

- Site-specific Preliminary Remediation Goal (PRG) – Lead in soil will be screened using a site-specific PRG for lead of 1,531 mg/kg, which was developed by USEPA (USEPA, 2010).

- USEPA Regional Screening Level (RSL) for Residential Soil – All other constituents that were detected in soil will be screened using the USEPA RSLs for residential soil (USEPA, 2012b). Although the Facility is zoned by the City of Kansas City for M1-5 (Manufacturing 1) with land use characterized as "3110 - Heavy Industry", this zoning is not an adequate institutional control to ensure that the future use of the Facility will remain industrial. Therefore, screening using the RSLs for residential soil was selected until additional institutional controls are proposed as part of the final remedy. As noted in the following paragraph, exceptions will be made for constituents that have background concentrations in excess of the residential RSL.

- Blue Valley Corridor Background: The United States Army Corps of Engineers (USACE) in collaboration with the City of Kansas City, Missouri and USEPA conducted a soils background study of metals and polynuclear aromatic hydrocarbons (PAHs) for the Blue Valley Industrial Corridor Renewal Project (USACE, 2003). This background study was funded as a Brownfields Showcase Project to support redevelopment projects along the Blue River in Kansas City, Missouri. Since the Blue River bisects the Facility, these background values are relevant. If a constituent's residential RSL is less than the Blue Valley background value, then the background value will be used for screening (see Table 2-1). This is applicable for arsenic, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

The decision process for screening the soil data will be as follows:

- Step 1: Soil data for each SWMU/AOC will be screened on a point by point basis. If the maximum detected concentration for a constituent within a SWMU/AOC exceeds its residential RSL, the constituent will be carried forward to the Step 2 of the decision process. As noted above, exceptions will be made for lead, which has a site-specific PRG, and for arsenic, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, which have background values higher than the residential RSLs. If the maximum detected concentration for a constituent does not exceed the screening criteria, then no further evaluation will be conducted for that constituent in the SWMU/AOC as part of the CMS.

- Step 2: If the maximum detected concentration of a constituent for a SWMU/AOC exceeds the screening level, then the SWMU/AOC will be carried forward for additional risk evaluation or move directly into evaluation of corrective measures alternatives. Additional risk evaluation will be performed in accordance with *Risk Assessment Guidance for Superfund, EPA/540/1-89-002* (USEPA, 1989) with any subsequent updates, amendments, or supplements. Soil contamination will be evaluated in accordance with *Soil Screening Guidance* (USEPA, 1996).

2.2.1.2 SWMUs and AOCs East of I-435

Manufacturing was not performed in parts of the Facility east of I-435. This area was primarily used for waste disposal in landfills (i.e., RCRA Landfill, SWMU 2, and SWMU 5) and landfarming (SWMU 12). For a brief period, the Facility had private rail lines that transferred materials and products to a barge dock on the Missouri River for shipment. The screening levels for this area are presented on Table 2-2 and include the following:

- USEPA RSL for residential soil (USEPA, 2012)

- USEPA Region 5 Ecological Screening Levels (USEPA, 2003)

- Blue Valley Industrial Corridor Background Values (USACE, 2003)

- Site-specific PRG for lead (USEPA, 2010)

The decision process for screening the soil data will be as follows:

- Step 1: Soil data for each SWMU/AOC will be screened on a point by point basis. The maximum detected concentration for a constituent within a SWMU/AOC will be compared to the lesser of the USEPA RSL for residential soil or the Region 5 ecological screening level. Exceptions will be made when a constituent's residential RSL and/or ecological screening level is less than the Blue Valley background value. In those cases, the Blue Valley background value will be used for screening (see Table 2-2). This is applicable for cadmium, chromium (total and trivalent), benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. An additional exception will be made for lead, which has a site-specific PRG. If the maximum detected concentration for a constituent within a SWMU/AOC exceeds the screening level, the constituent will be carried forward to the Step 2 of the decision process. If the maximum detected concentration for a constituent does not exceed the screening criteria, then no further evaluation will be conducted for that constituent in the SWMU/AOC as part of the CMS.

- Step 2: If the maximum detected concentration of a constituent for a SWMU/AOC exceeds the appropriate screening level, then the SWMU/AOC will be carried forward for additional risk evaluation or move directly into evaluation of corrective measures alternatives. Additional risk evaluation will be performed in accordance with *Risk Assessment Guidance for Superfund, EPA/540/1-89-002* (USEPA, 1989) with any subsequent updates, amendments, or supplements and/or *Guidelines for Ecological Risk Assessment* (USEPA, 1998). Soil contamination will be evaluated in accordance with *Soil Screening Guidance* (USEPA, 1996).

2.2.2 Groundwater Screening Process

The screening criteria for groundwater are presented on Table 2-3. This table presents screening levels for constituents that have been detected in groundwater samples at the Facility. The screening levels were based on the following conventions:

- The analytical data for groundwater will be screened using the Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for constituents that have MCLs.

- If a constituent does not have a MCL, then the USEPA RSL for tapwater (USEPA, 2012b) will be used for groundwater data screening.

Groundwater data for each SWMU/AOC will be screened on a point by point basis. In addition, the evaluation of potential cumulative effects will be performed.

2.3 PROPOSED DEVELOPMENT OF MEDIA CLEANUP STANDARDS

Media cleanup standards are intended to meet requirements for protection of human health and the environment. Preliminary media cleanup standards for soil and groundwater include the screening criteria established in Section 2.2, which are summarized as follows:

- Soil – SWMUs and AOCs West of I-435: The preliminary media cleanup standards for SWMUs 6, 7, 13, 17, 24, and 33, and AOCs 1 and 4 are the USEPA RSLs for residential soil. Exceptions will be made for lead, which has a site-specific PRG and for arsenic, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, which have background values above the USEPA RSLs for residential soil.

- Soil – SWMUs and AOCs East of I-435: The preliminary media cleanup standards for SWMU 4, SWMU 12, and AOC 8 will be the lesser of the USEPA residential soil or the USEPA Region 5 ecological screening level. Exceptions will be made for lead, which has a site-specific PRG, and cadmium, chromium, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, which have background values above the USEPA Region 5 ecological screening levels and/or USEPA RSLs for residential soil.

- Groundwater: The preliminary media cleanup standards for groundwater will be the MCL. If an MCL does not exist for a compound, then the USEPA RSL for tapwater will be used. In addition, potential cumulative effects will be evaluated.

As a component of a proposed final remedy, site-specific corrective action objectives (CAOs) may also be developed based upon site-specific chemical, media, and future land use considerations. Site-specific CAOs will be developed based on site-specific risk analysis and incorporate media of concern, potential contaminants of concern, potentially exposed populations and pathways, and exposure assumptions. Relevant considerations for the development of site-specific CAOs are provided in the following paragraphs.

Land use near the Facility is characterized by medium to heavy industrial development, and the Facility is zone M1-5 – Manufacturing 1, with a land use of “3110 – Heavy Industry” by the city of Kansas City, Missouri. Future use of the Facility is anticipated to remain industrial. Localized residential developments are located southeast and west of the Facility. Overland access to the Facility by the public is limited by perimeter fencing, gates, and guards throughout most of the Facility. The Facility is marginally accessible from the Blue and Missouri Rivers and Rock Creek.

Major surface water bodies near the Facility include the Blue River, Rock Creek, and the Missouri River. The majority of the Facility lies within then 100-year floodplain.

Groundwater flow beneath the Facility is generally to the north-northeast toward the Blue and Missouri Rivers. Groundwater is not used for any purpose at the Facility, and potable water is supplied by the city of Kansas City, Missouri. The following Kansas City, Missouri Code of Ordinances prohibits the installation of private-use supply wells for commercial and public buildings or residential dwellings:

- Chapter 18 of the Code, Article VII, Section 18-125, adopts the Uniform Plumbing Code ("UPC") for commercial and public buildings. Chapter 6 of the UPC requires, in pertinent part, that "[e]xcept where not deemed necessary for safety or sanitation by the Authority Having Jurisdiction, each plumbing fixture **shall be provided with an adequate supply of potable running water . . . .**" (Emphasis added). The only exception to this is in jurisdictions which adopt Appendix J of the UPC (allowing for the use of reclaimed water), which the City does not. Also, Section 18-125 defines building supply, in pertinent part, as "[t]he pipe carrying **potable water** from the water main or other source of **potable water supply** to the first shut-off valve downstream of all the following (as applicable): 1. the point of entrance into the building; 2. the water meter; and 3. the service backflow prevention device." (Emphasis added).

The anticipated future uses for groundwater beneath the Facility are expected to remain unchanged.

2.4 PROPOSED DEVELOPMENT OF POINTS OF COMPLIANCE

Points of compliance are the site-specific locations at which the concentrations of individual constituents should meet the media cleanup standards. Definitive points of compliance for each SWMU and/or AOC will be developed as part of the CMS. For surficial exposure scenarios (i.e., direct contact with soils or groundwater, inhalation of vapors, etc.), the point of compliance will likely be established within the SWMU or AOC boundary. The points of compliance for exposures based on migration of contamination within groundwater are expected to be the downgradient boundary of the SWMU or AOC, consistent with 40 CFR 264.95.

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3.0 CMS ALTERNATIVES

The purpose of Section 3.0 is to identify and evaluate potential remedial alternatives for constituents identified during the SWMU/AOC screening process (see Section 2.2). The initial step in the evaluation process consists of the identification of potentially applicable technologies that may be utilized for the management, containment, treatment, stabilization, and/or disposal of contaminated materials. The technologies selected for preliminary screening represent a range of responses commonly used to address soil and groundwater contamination.

Potential remedial alternatives will be evaluated in detail in the CMS Report for specific SWMUs and AOCs. The criteria utilized in the CMS Report to evaluate the potential remedial alternatives are documented in Section 4.0. The goal of the evaluation process is to choose remedies that are protective of human health and the environment, economically feasible, readily implementable, and provide rapid site restoration. The criteria utilized are consistent to those presented in the RCRA Corrective Action Plan (USEPA, 1994).

3.1 IDENTIFICATION OF POTENTIALLY APPLICABLE TECHNOLOGIES

The first step in developing a recommendation for corrective measures is to identify technologies that may be used to remediate contaminants of concern under the conditions present at the Facility. Tables 3-1 through 3-6 present a range for technologies commonly used in the environmental field to remediate soil and groundwater contamination. The technologies were grouped into six distinct subsets based on their potential application at the Facility. The remedial subsets are:

- “No Action” (Table 3-1);
- Engineering and institutional controls(Table 3-2);
- Source control technologies (Table 3-3);
- Ex-situ soil treatment technologies (Table 3-4);
- In-situ soil treatment technologies (Table 3-5); and
- Groundwater technologies (Table 3-6).

A brief description of each technology is provided in the tables. General comments regarding the potential effectiveness and implementability of each technology are also provided as part of the screening process. Relative unit costs were included; however, these costs will vary significantly from site-to-site and were used as a preliminary indication of the financial resources required to implement each technology. A comments column was provided to document any relative information not covered under the description, effectiveness, implementability, or relative cost headings.

3.1.1 "No Action"

"No action" means that the SWMU/AOC is left "as is". Under the "No action" alternative, institutional controls/use restrictions are not implemented, remediation for contamination will not be included, and no monitoring is conducted. It is used as a baseline for comparing all other alternatives (see Table 3-1).

3.1.2 Engineering and Institutional Controls

Engineering and institutional controls involve the creation and implementation of controls for regulating public and environmental contact with contaminants (see Table 3-2).

3.1.2.1 Access Control

Access control restrictions have been implemented at the Facility. Access at the Facility is currently controlled by perimeter fencing, gates, and/or security systems (remote surveillance, guards, etc.). Since access controls are maintained for public safety regardless of remedial success, they will be maintained in the foreseeable future.

3.1.2.2 Institutional Control/Use Restrictions

Institutional controls and use restrictions can be utilized to prevent exposure to contamination by prohibiting inappropriate use of the area. Activity and use limitations can encompass several categories including land use restrictions, soil restrictions, groundwater restrictions, and construction restrictions. For example, institutional controls and use restrictions can be used to prohibit the installation of groundwater supply well in contaminated aquifers and restrict the disturbance of areas with soil contamination. Implementation of institutional controls/use restrictions does not physically alter conditions at the Facility or reduce the volume, toxicity, or mobility of contaminants of concern. Since the impacted groundwater is not used and alternative water supply sources area available, a restriction on groundwater use would not adversely impact neighboring properties.

In particular, the Missouri Environmental Covenants Act (MoECA), found in the Missouri Revised Statutes at sections 260.1000 to 260.1039, RSMo., provides a uniform standard for environmental covenants. The law provides standards for and increases the reliability of covenants used as part of the cleanup of contaminated sites in Missouri. The act does not require the use of environmental covenants, but provides a statutory framework when they are used. Environmental covenants describe limitations on future land use and activities at a specific property in order to minimize or eliminate exposure to remaining contamination. Environmental covenants also specify how and by whom the limitations can be enforced. Property owners must follow the environmental covenants for as long as the contaminants present on the property pose a potential risk. Environmental covenants are recorded in a property's chain of title and notify prospective buyers of specific limitations about land use and activities due to the environmental condition of the property (MDNR, 2011).

3.1.3 Source Control Technologies

Source control can be used to cover or surround a contaminated area to limit migration of contaminants (see Table 3-3).

3.1.3.1 Caps

Surface capping provides a physical barrier that is effective in minimizing the potential direct exposure of humans and the environment to contaminants. Surface barriers limit infiltration of water into materials that would create contaminated leachate and prevent transportation by erosion, thereby reducing the long-term mobility of contaminants beneath the caps. Capping is generally combined with surface grading and contouring that directs surface water runoff to further minimize infiltration and ponding. Surface caps are already in place at SWMUs 2, 3, and 5.

3.1.3.2 Constructed Barriers

To minimize the migration of groundwater contamination, a vertical barrier can be installed into the subsurface. Examples of constructed barriers include: slurry walls, grout curtains, sheet piling, and synthetic sheeting. The effectiveness of the barrier is dependent upon the barrier's permeability, resistance to deterioration, and imperfections. Barriers are most favorable when groundwater is less than 20 feet bgs and an aquitard is within 40 feet of the ground surface. Sheet piling is in place along the paved portion of the Blue River in the SWMU 33 area, and the Blue River in this area is a paved channel.

3.1.3.3 Surface Contouring

Surface contouring is also considered feasible technology for SWMUs and AOCs at the Facility. Surface contouring has already been performed for SWMUs 2, 3, and 5. At these SWMUs, surface grading and contouring directs surface water runoff to minimize infiltration. Well-maintained features are effective at intercepting, diverting, and routing surface water away from contaminated areas.

3.1.4 Ex-Situ Soil Treatment Technologies

Ex-situ soil treatment involves excavating contaminated soil and/or waste for on-site or off-site disposal (see Table 3-4).

3.1.4.1 Solidification/Stabilization

Solidification/stabilization reduces the mobility of hazardous substances and contaminants in the environment through both physical and chemical means. Leachability testing is typically performed to measure the immobilization of contaminants. For ex-situ solidification/stabilization, soil is excavated and mixed with cement or a other stabilizing reagent. Solidification/stabilization is generally effective for the treatment of metals and SVOCs. It is generally not recommended for sludge or extremely oily soils.

3.1.4.2 Off-Site Landfilling

Off-site disposal of contaminated soils in a permitted landfill is a feasible remedial technology. The technology is utilized extensively in hazardous waste site remediation and is effective for the contaminants found at the Facility. During excavation of contaminated soil, dust and vapor control provisions would be implemented to protect on-site workers and the environment from vapor and fugitive dust emissions. Dewatering or pretreatment of the soil may be required. Waste transported to the landfill must meet federal and state shipping, manifesting, and land disposal restriction regulations. The volume and characteristics of the waste requiring excavation and disposal are the primary factors determining implementability and cost.

3.1.5 In-Situ Soil Treatment Technologies

In-situ treatment (treating soil or waste in place in the ground) can minimize disturbance to the land surface (see Table 3-5).

3.1.5.1 Soil Vapor Extraction

Soil vapor extraction (SVE) is an in-situ unsaturated (vadose) zone soil remediation technology in which a vacuum is applied to the soil to induce the controlled flow of air and remove volatile and some semivolatile contaminants from the soil. The gas leaving the soil may be treated to recover or destroy the contaminants, depending on air discharge regulations. The target contaminant group for in-situ SVE are VOCs and some fuels. The technology is typically applicable only to volatile compounds with a Henry's law constant greater than 0.01 or a vapor pressure greater than 0.5 mm Hg (0.02 inches Hg). Other factors, such as the moisture content, organic content, and air permeability of the soil, will also influence the effectiveness of in-situ SVE. Soil that has a high percentage of fines and a higher degree of saturation will require higher vacuums (increasing costs) and/or hindering the operation of the in-situ SVE system.

In-situ SVE can also be conducted in conjunction with other in-situ soil remediation technologies and groundwater treatment technologies. Dual phase extraction (DPE) (fluid/vapor extraction) is an in-situ remediation technology that is applied to areas of soil and groundwater contamination. Discussion of DPE is presented in Section 3.1.5.5.

Results from a SVE/DPE pilot study performed at SWMU 33 indicated that SVE and DPE were viable technologies for remediation of VOCs in soil at SWMU 33.

3.1.5.2 Solidification/Stabilization

Solidification/stabilization reduces the mobility of hazardous substances and contaminants in the environment through both physical and chemical means. Leachability testing is typically performed to measure the immobilization of contaminants. Soil is treated in-place. Solidification/stabilization is generally effective for the treatment of metals and SVOCs. It is generally not recommended for sludge or extremely oily soils.

3.1.5.3 Chemical Oxidation/Reduction

Discussion of chemical oxidation-reduction is presented in Section 3.1.6.4.

3.1.6 Groundwater Technologies

Groundwater treatment technologies include passive and active techniques and can be conducted in-situ or ex-situ (see Table 3-6).

3.1.6.1 Long-Term Monitoring

A long-term groundwater monitoring and analysis program may be used to identify changes in groundwater flow patterns, contaminant levels, and to track contaminant plume migration. In the absence of remedial action, monitoring will not reduce the contaminant migration, nor prevent contaminant levels from increasing. However, monitoring provides an effective method to assess the potential impact of contaminants on identified receptors. Long-term monitoring is a component of monitored natural attenuation to confirm natural subsurface biological, chemical, and physical processes such as dispersion, volatilization, dilution, adsorption, and biodegradation are occurring consistent with cleanup objectives.

3.1.6.2 Monitored Natural Attenuation with Source Control

Monitored natural attenuation relies on natural biological, chemical, and physical processes to reduce contaminant levels. Natural attenuation includes both nondestructive mechanisms (dispersion, volatilization, dilution, and adsorption) as well as destructive mechanisms, such as biodegradation. Consideration of this option usually requires modeling and evaluation of contaminant degradation rates and pathways and predicting contaminant concentration at downgradient receptor points, especially when the plume is still expanding/migrating. In addition, long term monitoring must be conducted throughout the process to confirm that degradation is proceeding at rates consistent with meeting cleanup objectives. Monitored natural attenuation can be used independently, or in conjunction with other remediation technologies, such as source control. Target contaminants for natural attenuation are VOCs, SVOCs, and fuel hydrocarbons.

3.1.6.3 Enhanced Bioremediation

Enhanced bioremediation involves the addition of microorganisms or nutrients to the subsurface to increase degradation of organics by indigenous microbes, either aerobically or anaerobically. Enhanced aerobic bioremediation involves the introduction of a supplemental oxygen supply to the subsurface to stimulate hydrocarbon degradation, while enhanced anaerobic bioremediation involves the introduction of a supplemental carbon source to stimulate reductive dechlorination of chlorinated solvents. Appropriate subsurface conditions, whether aerobic or anaerobic, must exist to support effective biological activity to consider enhanced bioremediation. Enhanced bioremediation technologies are generally used for lower concentration, downgradient plume portions, while more aggressive remediation technologies are more effective for treating high concentration source areas. A wide range of compounds are available with varying treatment times, in some cases up to five years. Several rounds of compound application may also be required, depending on site conditions. Target compounds for enhanced bioremediation are VOCs and fuel hydrocarbons.

3.1.6.4 Chemical Oxidation/Reduction

In the chemical oxidation and reductive processes, oxidizing or reducing compounds, respectively, are introduced to contaminated zones to facilitate the complete breakdown of VOCs, especially chlorinated solvents. Chemical oxidation/reduction can be applied to the aquifer directly through injection points or as part of a treatment wall/reactive barrier. Multiple application events may be required when applied via injection methods and replacement of reactive material in treatment wall/reactive barrier configurations may be required prior to achieving cleanup goals. Commonly used oxidants for remediation of chlorinated solvents in groundwater are ozone, hydrogen peroxide in combination with ferrous iron (i.e., Fenton's reagent), persulfate in combination with ferrous iron, and permanganate. The most commonly used reductant is zero-valent iron.

Ozone and Fenton's reagent result in degradation without the formation of intermediate daughter products. The materials for Fenton's reagent are relatively inexpensive and non-toxic, while a more complex site setup is required for ozone. Low pH conditions are required for optimized use of Fenton's reagent, and control of in-situ heat and gas produced during application of ozone and Fenton's reagent can be problematic. Permanganate operates over a wider pH range and is generally more stable and less costly than other oxidants. However, potential regulatory and water quality concerns exist due to increased manganese concentrations in the subsurface when using permanganate; likewise, increased sodium sulfate concentrations in the subsurface is a potential concern when using persulfate. In addition, groundwater can become stained purple from unreacted permanganate. Fenton's reagent, permanganate, and persulfate have the potential to produce particulates during the reaction that can reduce permeability in fine-grained materials. Zero-valent iron also has the potential to reduce aquifer permeability when injected. Emulsified zero-valent iron compounds have demonstrated effective remediation of dense non-aqueous phase liquids.

3.1.6.5 Air Sparging

Air sparging is an in-situ technology in which air is injected through a contaminated aquifer. Injected air traverses horizontally and vertically in channels through the soil column, creating an underground stripper that removes contaminants. The injected air helps to flush (bubble) the contaminants up into the unsaturated zone where a vapor extraction system removes the generated vapor phase contamination. This technology is designed to operate at high flow rates to maintain increased contact between groundwater and soil and to strip more groundwater by sparging. Oxygen added to contaminated groundwater and vadose zone soils can enhance biodegradation of contaminants below and above the water table. The target contaminant groups for air sparging are VOCs and fuels.

3.1.6.6 Dual Phase Extraction

Fluid/vapor extraction (also referred to as DPE) can be used to remediate VOCs in soil and groundwater. A high vacuum system is applied to remove liquid and gas from low permeability or heterogeneous formations. The vacuum extraction well is screened in the zone of contaminated soils and groundwater. The system lowers the water table around the well, exposing more of the formation. Contaminants in the newly exposed vadose zone are then accessible to vapor extraction. Because of the turbulence created during extraction, most of the contaminants in the water are stripped away, and little additional treatment is needed. It is more effective than SVE for heterogeneous clays and fine sands.

3.2 REMEDIAL ALTERNATIVE EVALUATION IN CMS

This section identifies the remedial alternatives that will be evaluated for each SWMU/AOC.

3.2.1 Facility-Wide Alternatives

The following engineering and institutional controls will be evaluated on a Facility-wide basis as part of the CMS:

- Access controls
- Institutional Control/Use Restrictions

3.2.2 Landfills

SWMUs 2, 3, and 5 are capped landfills. The following alternatives may be evaluated in the CMS Report for each of these landfills:

- Long-term monitoring (LTM)
- Cap inspection and maintenance

3.2.3 Metals in Soil

In the preliminary screening, metals were identified in soil at SWMUs 4, 6, 7, 12, and 24 and AOC 8 in excess of the screening levels. If secondary screening indicates that metals should be carried forward as part of the CMS, the following alternatives may be evaluated in the CMS Report for each of these SWMUs/AOC:

- Capping
- Stabilization (as needed)
- Offsite landfilling

3.2.4 Organics in Soil

In preliminary screening, organics were identified in soil at SWMUs 6, 12, 24, and 33 and AOCs 1 and 4 in excess of the screening levels. If secondary screening indicates that organics should be carried forward as part of the CMS, the following alternatives may be evaluated in the CMS Report for each of these SWMUs/AOCs:

- Capping
- Stabilization/solidification
- SVE
- Chemical oxidation/reduction
- Offsite landfilling

3.2.5 Groundwater

In preliminary screening, organics were identified in groundwater at SWMUs 17 and 33 in excess of the screening levels. Arsenic was identified in groundwater in excess of the screening levels at SWMU 13. The following alternatives may be evaluated in the CMS Report for groundwater:

- LTM
- Monitored natural attenuation with source control
- Air sparging
- DPE
- Chemical oxidation/reduction
- Enhanced bioremediation

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4.0 EVALUATION OF CORRECTIVE MEASURES

4.1 TECHNIQUE FOR EVALUATION OF CORRECTIVE MEASURE ALTERNATIVES

The purpose of a CMS is to identify and evaluate potential remedial alternatives for facilities requiring corrective action. Selection of appropriate corrective measure alternatives is based on the principle that the selected alternative is protective of human health and the environment. USEPA currently has the following expectations for corrective measures.

- Corrective measures should address the principal contamination threats posed by a site whenever practicable and cost-effective.
- Engineering controls, such as containment, for contaminated media are acceptable as corrective measures so long as minimal long-term threat to human health and the environment and remedial impracticability, are demonstrated.
- Active remediation, engineering controls, and institutional controls can be utilized concurrently at a site so long as human health and the environment are protected.
- Institutional controls, while useful in combination with engineering controls and active remediation, should not generally be used as the sole corrective measure for a site.
- Innovative remedial technologies should be favored over conventional remedial technologies as corrective measures when advantages of superior treatment or implementability, less adverse impact, or lower overall costs can be realized.
- Groundwater should be restored to its maximum beneficial usage wherever practicable within a reasonable, site-specific timeframe. Where groundwater restoration is not practicable, prevention or minimization of further groundwater plume migration; prevention of groundwater exposure to humans or the environment; and additional risk reduction evaluation, is necessary. Surface and/or subsurface sources of groundwater contamination should be controlled or eliminated.
- Corrective measures should be implemented on contaminated soils as necessary to prevent or limit direct exposure to human or environmental receptors and prevent transfer of unacceptable levels of contamination to other media via leaching, runoff, or airborne emissions.

4.2 DECISION MAKING PROCESS FOR CORRECTIVE MEASURE ALTERNATIVES

Evaluation of corrective measures will utilize the method first proposed by USEPA for the RCRA Corrective Action Program in 1990 and updated in the 1996 Proposed Rule on Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities. The USEPA has established a two-phased evaluation process for corrective measures evaluation and selection. During the first phase, potential remedial alternatives are screened to determine whether they meet four threshold criteria. Those remedies that meet all four threshold criteria are then re-examined during a second evaluation phase using five balancing criteria to identify which corrective measure is best suited to a specific situation.

The four threshold criteria that potential remedial alternatives must achieve to be given further consideration include:

- Protection of human health and the environment
- Attainment of media cleanup standards
- Control source of release
- Compliance with applicable standards for waste management

The five balancing criteria include:

- Long-term reliability and effectiveness
- Reduction of toxicity, mobility, or volume of wastes
- Short-term effectiveness
- Implementability
- Economic feasibility

Corrective measures will be first evaluated according to the threshold criteria. The relative merits of each alternative meeting the threshold criteria will be evaluated in relation to each of the balancing criteria. The criteria used for evaluation of each alternative are described in the following sections. The advantages and disadvantages of each alternative relative to one another will be identified. The comparative analysis of the alternatives will be presented in a narrative discussion or tables and will include a description of the following:

- Strengths and weaknesses of the alternatives relative to one another with respect to each balancing criterion

- Sensitivity of expected performance to reasonable variation of key uncertainties
- Differences between the alternatives (qualitative or quantitative)
- A description of potential advantages of an alternative in cost or performance, and the degree of certainty of these associated with each

4.2.1 Protection of Human Health and the Environment

Corrective action remedies must be protective of human health and the environment. Each alternative is evaluated on its potential to prevent exposure risk to humans and the environment during and after remedial action is initiated. Technologies posing the least short- and long-term risk to human health and the environment are the most desirable for remedial activities. Risks associated with source control and management of wastes generated during remedial actions are also considered in the evaluation. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	No risk to human health and the environment.
	Good	More protective than risk criteria.
	Adequate	Meets risk criteria.
UNFEASIBLE	Exceeds human health and environmental risk criteria.	

4.2.2 Attainment of Media Cleanup Standards

Media cleanup standards are the contaminant concentrations and site conditions that do not pose unacceptable risks to human health and the environment. Remedial alternatives are evaluated based on their ability to meet media cleanup standards at the point of compliance in an expeditious timeframe. Local geologic and waste characteristics are evaluated to determine if corrective action alternatives are capable of attaining media cleanup standards. When possible, each potential alternative's effectiveness is evaluated by comparing the estimated effectiveness of the various alternatives with case histories conducted in similar environments. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Remediation achieves background concentrations.
	Good	Cleanup results in concentrations less than media cleanup standards.
	Adequate	Meets media cleanup standards.
UNFEASIBLE	Unable to meet media cleanup standards.	

4.2.3 Control Source of Release

Remedial alternatives must be able to mitigate environmental degradation by controlling or eliminating future releases posing threats to human health or the environment. Source control strategies should offer both short- and long-term effectiveness at a particular SWMU/AOC. In evaluating the potential long-term effectiveness of source control alternatives, remedial alternatives providing waste treatment or destruction are preferable over alternatives relying on containment systems to prevent future releases. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Elimination of potential sources of contamination.
	Adequate	Management of potential sources of contamination.
UNFEASIBLE	Releases of contamination from source area are not controlled, potentially allowing risks to human health or the environment to increase in the future.	

4.2.4 Compliance with Applicable Standards for Waste Management

Remedial activities must be conducted in compliance with local, state, and federal regulations. Regulations were identified during the evaluation process potentially relating to each remedial alternative. Remedial alternatives unable to comply with applicable regulations are not considered feasible. The final determination of applicable technologies is subject to review and approval by USEPA and MDNR. The following table gives guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Exceeds regulatory requirements.
	Adequate	Compliant with regulatory requirements.
UNFEASIBLE	Unable to meet media applicable requirements for the SWMU or remedial program.	

4.2.5 Long-Term Reliability and Effectiveness

The long-term reliability and effectiveness criterion evaluates the ability of an alternative to prevent or minimize substantial danger to public health and the environment after the alternative has been implemented. Long-term reliability and effectiveness is evaluated for each alternative or combination of alternatives. The demonstrated effectiveness of selected remedial alternative(s) under analogous site conditions are considered in evaluating whether the alternative could be used effectively. The ability of an alternative to protect potential receptors during the failure of any one technology or uncontrollable changes at the site are considered. The estimated useful life of each alternative is also considered an important factor in evaluating long-term reliability. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Eliminates threat to human health. Remedial actions are permanent and require to no long-term maintenance.
	Good	Minimizes further contaminant migration and threat to human health. Major technologies are permanent, and other components continue to perform unattended with minimal maintenance.
	Adequate	Adequately protects human health by reducing contaminant releases. Overall remedial option may require regular maintenance.
	Poor	Provides for limited protection of human health by reducing the potential for exposure to contaminants. The long-term effectiveness is dependent upon maintenance.
UNFEASIBLE	Provides no protection to human health or the environment. After implementation, human or ecological receptors are exposed to elevated concentrations of harmful compounds. Remedial option may require frequent and extensive maintenance. Useful life of remediation equipment and processes may be less than restoration timeframe.	

4.2.6 Reduction of Toxicity, Mobility, or Volume

Remedial alternatives that minimize risk by reducing the toxicity, mobility, or volume of waste residuals are expected to provide the greatest long-term protection of human health and the environment. Permanent reduction of the waste's toxicity, mobility, or volume is the most desirable method of minimizing long term risks. This criterion is evaluated by comparing initial site conditions to expected post-corrective measure conditions. Recommended alternatives are chosen based on their expected effectiveness in reducing the toxicity, mobility, or volume of wastes found at each SWMU/AOC. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Elimination of toxicity, mobility, or volume of hazardous constituents with no generation of hazardous residuals.
	Adequate	Acceptable reduction of toxicity, mobility, or volume of primary hazardous constituents with manageable residuals.
UNFEASIBLE	No reduction in toxicity, volume, or mobility of hazardous constituents is provided. Exposure risk is not significantly reduced.	

4.2.7 Short-Term Effectiveness

Short-term effectiveness evaluates alternatives with respect to their effects on human health and the environment during implementation of the remedial action. Risks associated with the containment, treatment, excavation, transportation, or redisposal of waste materials are considered in the evaluation process. The objective is to minimize the risk to the community, workers, and the environment prior to, during, and after remediation. Remedial alternatives providing rapid restoration of the impacted area without adverse impact on workers, the community, or the environment are preferred. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	The implementation period is short and the proposed remedial activities pose no risk to the community, workers, or environment.
	Good	Potential for waste exposures during implementation is low. Implementation poses limited risk to the community, although workers may be required to use personal protective equipment to prevent intake. Releases during implementation, if any, would be minor. Potential releases would have minimal impact on the environment.
	Adequate	Potential for waste exposure during implementation is low. Implementation poses limited risk to community and workers are required to use personal protective equipment to prevent intake. Releases during implementation are anticipated but will be controlled to limit potential adverse environmental or health impacts. The proposed remediation is expected to achieve desired results in 2 to 10 years.
	Poor	Exposure to waste constituents during implementation is likely. Releases would be monitored and controlled; however, implementation may have limited effects on the community from releases of concentrations above threshold limits. Workers are required to use personal protective equipment to prevent intake. Releases could result in limited unacceptable impact on the environment.
UNFEASIBLE	Exposure to waste constituents during implementation is likely. Implementation may create unpredictable adverse effects on the community or unacceptable/uncontrolled damage to the environment form releases of chemicals above threshold limits. Implementation is expected to require more than 30 years to reach cleanup goals.	

4.2.8 Implementability

Implementability addresses the technical and administrative feasibility of initiating an alternative, and the availability of various services and materials required. Technical feasibility considers the ease of construction and operation of a particular alternative, the potential for technical problems during implementation, the ease of undertaking additional remedial action in the future, and the ability to monitor the effectiveness of the proposed alternative. Administrative implementability refers to administrative requirements that may be requested by various regulatory agencies. An alternative to be initiated expeditiously with minimal effort is most desirable. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	No implementability concerns.
	Good	May be implemented with minor technical concerns.
	Adequate	Implementation is possible, but administrative, technical, and regulatory issues prevent rapid implementation of the alternative.
	Poor	Technical, administrative, and/or regulatory issues, make implementation of remedial alternative difficult.
UNFEASIBLE	Technical, administrative, or availability issues prohibit implementation.	

4.2.9 Economic Feasibility

Economic feasibility may be used to choose between several alternatives offering similar protection of human health and the environment. Capital and annual operation and maintenance costs are used in the evaluation of alternatives. The present worth of an alternative is the primary dollar figure used for comparative cost evaluation. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Limited financial obligation.
	Good	Relatively less costly than other alternatives.
	Adequate	Similar costs to other alternatives.
	Poor	Significantly more costly than other alternatives.
UNFEASIBLE	Cost prohibits implementation.	

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5.0 PILOT, LABORATORY, AND/OR BENCH SCALE STUDIES

Remedial technologies may require additional testing to determine appropriateness for application at a specific SWMU or AOC. Bench scale studies, laboratory tests, and/or pilot studies can be conducted to determine implementabilty and effectiveness or remedial technologies based on site-specific factors. If it is determined that a pilot, laboratory, and/or bench scale study(s) is warranted, a detailed description of the proposed study(s) and a schedule for implementation will be provided to USPEA and MDNR. For example, the additional studies may be warranted if the following remedial alternatives are selected:

- Treatment of soil using solidification/stabilization (in-situ or ex-situ) techniques will require bench testing to identify binding reagents which will improve the chemical and physical characteristics of the soils. A pilot study (field test) would also be conducted to verify if the reagent/soil mixture ratios identified in the bench test achieve adequate stabilization/solidification.

- Chemical oxidation technology requires bench testing to determine natural oxidant demand and calculate oxidant dosage.

- SVE, air sparging, and DPE require pilot testing to confirm feasibility and effectiveness under site-specific conditions. A SVE/DPE pilot test was performed in 2011 at SWMU 33 to evaluate the technologies for remediation of impacted soil the site. The results of the pilot test indicated that SVE and DPE were viable technologies for remediation of the soil source at the site. Further details regarding the SVE/DPE pilot test at SWMU 33 are provided in the *Supplemental Investigation Addendum Report and Pilot Study Work Plan* (BMcD, 2010a) and the *SVE/DPE Pilot Test Evaluation for the SWMU 33 Nail Mill Degreasing Area, AK Steel, Kansas City, Missouri* (BMcD, 2011).

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6.0 CMS REPORT OUTLINE

A CMS Report will be prepared that presents an update to current conditions, additional SWMU/AOC constituent evaluations (i.e., 95 UCL calculations, SWMU/AOC-specific risk assessment, etc.), media cleanup standards, and the corrective measures evaluation. A proposed outline for the CMS Report follows:

1.0 INTRODUCTION
- 1.1. Purpose and Scope
- 1.2. Background
  - 1.2.1. Facility Location
  - 1.2.2. Facility History
  - 1.2.3. Tasks Completed to Date
- 1.3. Environmental Setting

2.0 Description of Current Conditions and SWMU/AOC Screening
- 2.1. SWMU 2 – Old Blue River "W" Landfill
- 2.2. SWMU 3 – South of Bar Fab Landfill
- 2.3. SWMU 4 – 1987 Waste Pile
- 2.4. SWMU 5 – Plant Rubble Landfill
- 2.5. SWMU 6 – RCRA Permitted Baghouse Dust Tanks
- 2.6. SWMU 7 – No. 1 Melt Shop Baghouse Dust Tanks
- 2.7. SWMU 12 – AMOCO Landfarm
- 2.8. SWMU 13 – Pickle Liquor Tanks
- 2.9. SWMU 17 – Wire Mill Rinsewater Neutralization Tank
- 2.10. SWMU 24 – Waste Hydraulic Lubricating Oil Storage Tanks
- 2.11. SWMU 33 – Nail Mill Degreasing Area
- 2.12. AOC 1 – Abandoned Fuel Oil Storage Tank
- 2.13. AOC 4 – Boiler Furnace Area
- 2.14. AOC 8 – "Owl Gun Club" Shooting Park

3.0 ESTABLISHMENT OF CORRECTIVE ACTION OBJECTIVES
- 3.1. Target Media Cleanup Standards (Numerical Standards)
- 3.2. Non-Numerical Cleanup Standards
- 3.3. Compliance Points

4.0 REMEDIAL ALTERNATIVE EVALUATION PROCESS
- 4.1. Identification and Screening of Potentially Applicable Remedial Alternatives
- 4.2. Potential Corrective Action Alternatives
- 4.3. Screening Criteria for Potential Corrective Measures Alternatives
  - 4.3.1. Protection of Human Health and the Environment
  - 4.3.2. Attainment of Media Cleanup Standards
  - 4.3.3. Control Source of Release
  - 4.3.4. Compliance with Local, State, and Federal Regulations
  - 4.3.5. Long-Term Reliability on Effectiveness
  - 4.3.6. Reduction of Toxicity, Mobility, or Volume
  - 4.3.7. Short-Term Effectiveness

- 4.3.8. Implementability
- 4.3.9. Economic Feasibility
- 4.4. Recommendations

5.0 CORRECTIVE MEASURES ALTERNATIVES EVALUATION
- 5.1. Site-Wide Corrective Measures Assumptions
- 5.2. SWMUs/AOCs on Property East of I-435
  - 5.2.1. SWMU 2 – Old Blue River “W” Landfill
  - 5.2.2. SWMU 4 – 1987 Waste Pile
  - 5.2.3. SWMU 5 – Plant Rubble Landfill
  - 5.2.4. SWMU 12 – AMOCO Landfarm
  - 5.2.5. AOC 8 – “Owl Gun Club” Shooting Park
- 5.3. SWMUs/AOCs South of 24 Highway
  - 5.3.1. SWMU 3 – South of Bar Fab Landfill
  - 5.3.2. SWMU 7 – No. 1 Melt Shop Baghouse Dust Tanks
- 5.4. AOC 1 – Abandoned Fuel Oil Storage Tank
- 5.5. SWMUs/AOCs at the Former Tank Farm
  - 5.5.1. SWMU 6 – RCRA Permitted Baghouse Dust Tanks
  - 5.5.2. AOC 4 – Boiler Furnace Area
  - 5.5.3. SWMU 24 – Waste Hydraulic Lubricating Oil Storage Tanks
- 5.6. SWMUs Associated with Nail Mill Degreaser VOC Plume
  - 5.6.1. SWMU 13 – Pickle Liquor Tanks
  - 5.6.2. SWMU 17 – Wire Mill Rinsewater Neutralization Tank
  - 5.6.3. SWMU 33 – Nail Mill Degreasing Area

6.0 SUMMARY AND CONCLUSIONS

7.0 REFERENCES

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7.0 PROJECT MANAGEMENT

7.1 ORGANIZATION

Planning, evaluation, and reporting for the CMS will be conducted by BMcD and coordinated with AK Steel, USEPA, and MDNR. Key project personnel are outlined in this section The project organization for the CMS is illustrated in Figure 7-1.

7.1.1 AK Steel

AK Steel will be responsible for providing day-to-day project coordination with the MDNR, USEPA, and BMcD. Mr. Cory Levengood will serve as the Primary Point of Contact. Contact information for Mr. Levengood is as follows:

Name	Primary Point of Contact
AK Asset Management Company 5050 Section Avenue Cincinnati, OH 65212	Mr. Cory Levengood Phone: (513) 772-2840 or (513) 425-2711 Email: cory.levengood@aksteel.com

7.1.2 USEPA

USEPA is providing regulatory oversight of AK Steel's RCRA corrective action activities under Part II of the Permit. USEPA has overall responsibility for project coordination and review responsibilities for the CMS. Mr. Bruce Morrison will serve as the USEPA Region 7 Project Manager. Contact information for the USEPA Project Manager is as follows:

Name	Primary Point of Contact
USEPA, Region 7 901 North 5th Street Kansas City, KS 66101-2907	Mr. Bruce Morrison Phone: (913) 551-7755 Email: morrison.bruce@epa.gov

7.1.3 MDNR

MDNR is providing regulatory oversight of AK Steel's post closure activities at the closed RCRA Landfill. In addition, MDNR is providing review and comments on project documents related to corrective action. MDNR will review project documents and submit comments to USEPA. Ms. Christine Kump-Mitchell will serve as the MDNR Project Manager. Contact information for the MDNR Project Manager is as follows:

Name	Primary Point of Contact
Missouri Department of Natural Resources St. Louis Regional Office 7545 S. Lindbergh, Suite 210 St. Louis, MO 63125	Ms. Christine Kump-Mitchell Phone: (314) 416-2464 Email: christine.kump@dnr.mo.gov

7.1.4 Burns & McDonnell

AK Steel has contracted BMcD to support AK Steel's corrective action activities as required by their Permit. BMcD will report directly to AK Steel. BMcD will have primary responsibility to prepare and execute project plans, investigations, and reports for the CMS. Work conducted on the CMS will be performed by qualified BMcD engineers, scientists, geologists, and technicians. Responsibilities specific to BMcD are discussed in the following sections.

7.1.4.1 Quality Control Director

The QC Director serves as the senior reviewer, providing technical QC, oversight, and direction for all aspects of the planning, execution, analyses, and reporting of the CMS. The QC Director, Mr. Walter McClendon, will ensure that the requirements established in BMcD's *Corporate Quality Control Manual* (BMcD, 2010c) are met for report and design reviews. The QC Director will select Review Team members for each discipline from personnel that are not directly involved in the project. Members of the Review Team will have qualifications, experience, and expertise equivalent to that of the Project Team. Contact information for the BMcD QC Director is as follows:

Name	Primary Point of Contact
Burns & McDonnell 9400 Ward Parkway Kansas City, MO 64114	Mr. Walter McClendon, PG Phone: (816) 822-4357 E-mail: wmcclendon@burnsmcd.com

7.1.4.2 Project Manager

The Project Manager serves as a direct liaison between AK Steel and the BMcD project team and coordinates all BMcD activities for the Facility. Ms. Sharon Shelton will serve as the Project Manager for BMcD. The BMcD Project Manager for this investigation will provide guidance, direction, and support to the project team and will ultimately be responsible to AK Steel for all BMcD project-related activities. The BMcD Project Manager will be the primary point of contact between BMcD and the AK Steel Project Manager, and all contracted services (e.g., laboratory, drillers, etc.). Responsibility for coordination with contracted services may be delegated by the Project Manager to a project team member such as the Project Chemist, Field Site Manager, or other qualified individual. Project Manager responsibilities include implementing adequate internal controls and review procedures to eliminate conflicts, errors, and omissions, and verifying technical accuracy. Contact information for the BMcD Project Manager is as follows:

Name	Primary Point of Contact
Burns & McDonnell	Ms. Sharon Shelton
9400 Ward Parkway	Phone: (816) 822-3168
Kansas City, MO 64114	E-mail: sshelton@burnsmcd.com

7.1.4.3 Engineering Manager

The BMcD Engineering Manager is responsible for supervising and directing all engineering design and technical remedial evaluations for the CMS. Mr. John Hesemann, P.E. will serve as the engineering manager for BMcD. The Engineering Manager will provide guidance, direction, and support to the design team and will be responsible for all engineering deliverables for the project. Contact information for the Engineering Manager is as follows:

Name	Primary Point of Contact
Burns & McDonnell	Mr. John Hesemann
425 South Woods Mill Road, Suite 300	Phone: (314) 682-1560
Chesterfield, MO 63017	E-mail: jhesemann@burnsmcd.com

7.1.4.4 Health and Safety Manager

The Health and Safety Manager (HSM) is a Certified Industrial Hygienist (CIH) who will provide professional support by reviewing all health and safety programs as they apply to this project. The HSM will approve the Health and Safety Plan (HASP) and all modifications to the plan as they affect the health and safety of field personnel. The HSM is responsible for providing professional health and safety support and oversight management to the Site Health and Safety Supervisor (SHSS). The HSM will review and provide support in all concerns regarding the health and safety of field personnel assigned to this project. Periodic field audits of the project work site may be conducted by the HSM to evaluate the adequacy of the program and implement any necessary changes. Contact information for the BMcD HSM is as follows:

Name	Primary Point of Contact
Burns & McDonnell	Mr. Eric Wenger, CIH
9400 Ward Parkway	Phone: (816) 822-3894
Kansas City, MO 64114	E-mail: ewenger@burnsmcd.com

7.1.4.5 Project Team

The BMcD project team will be experienced in investigation and remediation and will have shown technical proficiency in their respective professional areas of expertise (i.e., chemistry, geology, hydrogeology, engineering, etc.). They will be familiar with internal review processes and specific details for this project.

Members of the BMcD project team are responsible for conducting project work in the field or in the office. Their responsibilities include:

- Prepare planning documents and reports;
- Conduct field work;
- Report progress and problems to the Project Manager;
- Implement and/or recommend corrective actions regarding project activities to the Project Manager; and
- Review and correct work prior to submittal to the Project Manager.

The members of the BMcD project team have authority to take the following actions:

- Require or perform "on-the-spot" corrections of deficiencies found during project execution and;
- Implement and/or recommend corrective actions regarding project activities to the Project Manager.

7.1.5 Subcontractors

Subcontractors (drillers, excavators, surveyors, laboratories, etc.) will be retained to provide services to meet the objectives of the CMS, if necessary. The BMcD Project Manager will oversee performance of the subcontractors.

Subcontractors will be selected based on:

- capabilities and knowledge to perform the scope of work
- meeting health and safety requirements
- state or federal certification, as appropriate
- Facility and local knowledge
- availability of equipment and crews to meet required schedules
- cost of services

7.2 PROJECT SCHEDULE

The proposed schedule for completion of the CMS is based on the number of days elapsed from USEPA's approval of this CMS Work Plan. The CMS is scheduled to be completed, and the CMS Report submitted to USEPA 240 days following CMS Work Plan approval. For certain SWMU/AOCs, additional activities (i.e., data collection, pilot, laboratory, and/or bench scale studies) may be needed to adequately evaluate a SWMU/AOC or remedial option. If contingent activities are identified during development of the CMS Report, USEPA and MDNR will be made aware of the additional data needs and a proposal for contingent activities will be provided. If appropriate, a meeting will be held with USEPA and MDNR technical staff to discuss and agree upon the contingent CMS activities and a separate reporting schedule for the additional evaluation.

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TABLES

Table 2-1
Soil Screening Levels for CMS
SWMUs and AOCs West of I-435
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Parameter	Units	CMS Screening Level		
INORGANICS				
Arsenic, Total	mg/kg	24		BVBG
Barium, Total	mg/kg	15,000		Res RSL
Cadmium, Total	mg/kg	70		Res RSL
Chromium, Total	mg/kg	120,000	a	Res RSL
Chromium, Trivalent	mg/kg	120,000		Res RSL
Lead, Total	mg/kg	1,531		Site PRG
Mercury, Total	mg/kg	23	b	Res RSL
Mercury, Elemental	mg/kg	10	c	Res RSL
Selenium, Total	mg/kg	390		Res RSL
Silver, Total	mg/kg	390		Res RSL
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	mg/kg	8,700		Res RSL
1,1,2-Trichloroethane	mg/kg	1.1		Res RSL
1,1-Dichloroethane	mg/kg	3.3		Res RSL
1,1-Dichloroethene	mg/kg	240		Res RSL
1,2-Dichloroethane	mg/kg	0.43		Res RSL
1,2,4-Trichlorobenzene	mg/kg	22		Res RSL
2-Butanone	mg/kg	28,000		Res RSL
2-Hexanone	mg/kg	210		Res RSL
4-Methyl-2-pentanone	mg/kg	5,300		Res RSL
Acetone	mg/kg	61,000		Res RSL
Benzene	mg/kg	1.1		Res RSL
Carbon disulfide	mg/kg	820		Res RSL
Chlorobenzene	mg/kg	290		Res RSL
Chloroform	mg/kg	0.29		Res RSL
cis-1,2-Dichloroethene	mg/kg	160		Res RSL
Ethylbenzene	mg/kg	5.4		Res RSL
Methylene chloride	mg/kg	56		Res RSL
Styrene	mg/kg	6,300		Res RSL
Tetrachloroethene	mg/kg	22		Res RSL
Toluene	mg/kg	5,000		Res RSL
trans-1,2-Dichloroethene	mg/kg	150		Res RSL
Trichloroethene	mg/kg	0.91		Res RSL
Vinyl chloride	mg/kg	0.06		Res RSL
Xylene, m,p-	mg/kg	590		Res RSL
Xylene, o-	mg/kg	690		Res RSL
Xylenes, Total	mg/kg	630		Res RSL
SEMIVOLATILE ORGANIC COMPOUNDS				
1-Methylnaphthalene	mg/kg	16		Res RSL
2,4-Dimethylphenol	mg/kg	1,200		Res RSL
2-Methylnaphthalene	mg/kg	230		Res RSL
4-Methylphenol	mg/kg	6,100		Res RSL
Acenaphthene	mg/kg	3,400		Res RSL
Acenaphthylene	mg/kg		--	
Anthracene	mg/kg	17,000		Res RSL
Benzo(a)anthracene	mg/kg	0.15		Res RSL
Benzo(a)pyrene	mg/kg	0.386		BVBG
Benzo(b)fluoranthene	mg/kg	0.364		BVBG
Benzo(g,h,i)perylene	mg/kg		--	
Benzo(k)fluoranthene	mg/kg	1.5		Res RSL

Table 2-1
Soil Screening Levels for CMS
SWMUs and AOCs West of I-435
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Parameter	Units	CMS Screening Level	
SEMIVOLATILE ORGANIC COMPOUNDS			
Bis(2-ethylhexyl)phthalate	mg/kg	35	Res RSL
Butylbenzylphthalate	mg/kg	--	
Chrysene	mg/kg	15	Res RSL
Dibenzo(a,h)anthracene	mg/kg	0.178	BVBG
Dibenzofuran	mg/kg	78	Res RSL
Dimethyl phthalate	mg/kg	7,800	Res RSL
Di-n-butylphthalate	mg/kg	6,100	Res RSL
Fluoranthene	mg/kg	2,300	Res RSL
Fluorene	mg/kg	2,300	Res RSL
Indeno(1,2,3-cd)pyrene	mg/kg	0.323	BVBG
Naphthalene	mg/kg	3.6	Res RSL
Phenanthrene	mg/kg	--	
Phenol	mg/kg	18,000	Res RSL
Pyrene	mg/kg	1,700	Res RSL
TOTAL PETROLEUM HYDROCARBONS			
Diesel	mg/kg	--	
Gasoline Range Organics (C6-C10)	mg/kg	--	
Motor Oil	mg/kg	--	
TPH (extractable)	mg/kg	--	
TPH (volatile)	mg/kg	--	

Screening levels are presented for constituents that have been detected in soil samples collected from SWMUs and AOCs west of I-435 (i.e., SWMUs 6, 7, 13, 17, 24, and 33, and AOCs 1 and 4). Screening levels are not presented for constituents that were analyzed but not detected.

mg/kg - millgrams per kilogram

a - Hexavalent chromium has not been detected in soil at the Facility. Therefore, the screening level for trivalent chromium was used for total chromium.

b - Value is for mercuric chloride and mercury salts.

c - The elemental mercury screening level will only be used for screening in locations where the historical presence of mercury switches and gauges is known.

d - m-Xylene and p-Xylene could not be differentiated by lab. The lower screening level for m-xylene was used.

BVBG - Blue Valley Industrial Corridor Soils Background Study Report, Brownfields Showcase Project (USACE, 2003)

Res RSL - Residential Soil Regional Screening Level Summary Table (USEPA, May 2012)

Site-Specific PRG - Site-specific preliminary remediation goal for lead (USEPA, 2010)

Table 2-2
Soil Screening Levels for CMS
SWMUs and AOCs East of I-435

Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Parameter	Units	CMS Screening Level		
INORGANICS				
Cadmium, Total	mg/kg	3.94		BVBG
Chromium, Total	mg/kg	38.8		BVBG
Chromium, Trivalent	mg/kg	38.8	a	BVBG
Lead, Total	mg/kg	1,531		Site PRG
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	mg/kg	29.8		R5 Eco
2-Butanone	mg/kg	89.6		R5 Eco
Acetone	mg/kg	2.5		R5 Eco
Benzene	mg/kg	0.255		R5 Eco
Carbon disulfide	mg/kg	0.0941		R5 Eco
Chlorobenzene	mg/kg	13.1		R5 Eco
Ethylbenzene	mg/kg	5.16		R5 Eco
Methylene chloride	mg/kg	4.05		R5 Eco
Styrene	mg/kg	4.69		R5 Eco
Tetrachloroethene	mg/kg	9.92		R5 Eco
Toluene	mg/kg	5.45		R5 Eco
Xylene, m,p-	mg/kg	590	b	Res RSL
Xylene, o-	mg/kg	690		Res RSL
Xylenes, Total	mg/kg	10		R5 Eco
SEMIVOLATILE ORGANIC COMPOUNDS				
2-Methylnaphthalene	mg/kg	3.24		R5 Eco
Anthracene	mg/kg	1480		R5 Eco
Benzo(a)anthracene	mg/kg	0.15		Res RSL
Benzo(a)pyrene	mg/kg	0.386		BVBG
Benzo(b)fluoranthene	mg/kg	0.364		BVBG
Benzo(g,h,i)perylene	mg/kg	119		R5 Eco
Benzo(k)fluoranthene	mg/kg	1.5		Res RSL
Chrysene	mg/kg	4.73		R5 Eco
Dibenzo(a,h)anthracene	mg/kg	0.178		BVBG
Dibenzofuran	mg/kg	78		Res RSL
Fluoranthene	mg/kg	122		R5 Eco
Indeno(1,2,3-cd)pyrene	mg/kg	0.323		BVBG
Naphthalene	mg/kg	0.0994		R5 Eco
Phenanthrene	mg/kg	45.7		R5 Eco
Pyrene	mg/kg	78.5		R5 Eco
TOTAL PETROLEUM HYDROCARBONS				
TPH (extractable)	mg/kg		--	
TPH (volatile)	mg/kg		--	

Screening levels are presented for constituents that have been detected in soil samples collected from SWMUs and AOCs east of I-435 (i.e., SWMU 4, SWMU 12, and AOC 8). Screening levels are not presented for constituents that were analyzed but not detected.

mg/kg - millgrams per kilogram

a - BVBG value for total chromium was applied to trivalent chromium.
b - m-Xylene and p-Xylene could not be differentiated by lab. The lower screening level for m-xylene was used.

BVBG - Blue Valley Industrial Corridor Soils Background Study Report, Brownfields Showcase Project (USACE, 2003)

Res RSL - Residential Soil Regional Screening Level Summary Table (USEPA, May 2012)

R5 Eco - USEPA Region 5, RCRA, Ecological Screening Levels (USEPA, 2003)

Site-Specific PRG - Site-specific preliminary remediation goal for lead (USEPA, 2010)

Table 2-3
Groundwater Screening Levels for CMS

Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Parameter	Units	CMS Screening Level		
INORGANICS				
Arsenic	mg/L	0.01		MCL
Barium	mg/L	2		MCL
Cadmium	mg/L	0.005		MCL
Chromium, Trivalent	mg/L	16		RSL
Chromium, Total	mg/L	0.1		MCL
Lead	mg/L	0.015		MCL
Mercury	mg/L	0.002		MCL
Selenium	mg/L	0.05		MCL
Silver	mg/L	0.071		RSL
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	µg/L	200		MCL
1,1,2-Trichloroethane	µg/L	5		MCL
1,1-Dichloroethane	µg/L	2.4		RSL
1,1-Dichloroethene	µg/L	7		MCL
1,2-Dichloroethane	µg/L	5		MCL
1,2-Dichloropropane	µg/L	5		MCL
4-Methyl-2-pentanone	µg/L	1,000		RSL
Acetone	µg/L	12,000		RSL
Benzene	µg/L	5		MCL
Carbon disulfide	µg/L	720		RSL
Carbon tetrachloride	µg/L	5		MCL
Chloroform	µg/L	80	a	MCL
cis-1,2-Dichloroethene	µg/L	70		MCL
Ethylbenzene	µg/L	700		MCL
Methylene chloride	µg/L	5		MCL
Tetrachloroethene	µg/L	5		MCL
Toluene	µg/L	1,000		MCL
trans-1,2-Dichloroethene	µg/L	100		MCL
Trichloroethene	µg/L	5		MCL
Vinyl acetate	µg/L	410		RSL
Vinyl chloride	µg/L	2		MCL
Xylene, m,p-	µg/L	190		RSL
Xylene, o-	µg/L	190		RSL
Xylenes, Total	µg/L	10,000		MCL
SEMIVOLATILE ORGANIC COMPOUNDS				
2,4-Dimethylphenol	µg/L	270		RSL
2-Methylphenol	µg/L	720		RSL
4-Chloroaniline	µg/L	0.32		RSL
4-Methylphenol	µg/L	1,400		RSL
Benzo(a)pyrene	µg/L	0.2		MCL
Benzo(b)fluoranthene	µg/L	0.029		RSL
Benzo(k)fluoranthene	µg/L	0.29		RSL
Bis(2-ethylhexyl)phthalate	µg/L	6		MCL
Chrysene	µg/L	2.9		RSL
Fluoranthene	µg/L	630		RSL
Isophorone	µg/L	67		RSL
Naphthalene	µg/L	0.14		RSL
Phenanthrene	µg/L		--	
Phenol	µg/L	4,500		RSL
Pyrene	µg/L	87		RSL
TOTAL PETROLEUM HYDROCARBONS				
TPH (extractable)	mg/L		--	
TPH (volatile)	mg/L		--	

Table 2-3
Groundwater Screening Levels for CMS
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Parameter	Units	CMS Screening Level	
WATER QUALITY PARAMETERS			
Chloride	mg/L	--	
Nitrate as Nitrogen	mg/L	10	MCL
Nitrite as Nitrogen	mg/L	1	MCL
Sulfate	mg/L	--	
Total Organic Carbon	mg/L	--	

Screening levels are presented for constituents that have been detected in groundwater samples collected at the Facility. Screening levels are not presented for constituents that were analyzed but not detected.

mg/L - millgrams per liter
µg/L - micrograms per liter

a - Value is for total trihalomethanes: bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

MCL - Safe Drinking Water Act Maximum Contaminant Level (USEPA, 2009)

RSL - Regional Screening Level Summary Table for tapwater (USEPA, May 2012)

Table 3-1
"No Action"
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
No Action	Site is left "as is" with no remedial actions performed.	Dependent on site conditions.	Implementation is easy.	None	Used as a baseline comparison to other alternatives.

Table 3-2
Engineering and Institutional Controls
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Access Control	Prevents individuals from inadvertently coming in contact with areas of contamination. May include surveillance systems, artificial or natural barriers, entry control and signs.	Dependent on maintenance of boundaries and surveillance systems and proper training of security force.	Currently implemented Facility-wide.	Access control is currently being implemented and financed under existing operations.	
Institutional Controls / Use Restrictions	Missouri Environmental Covenants Act (MoECA) document	Dependent on enforcement vehicle.	Administrative effort is required to draft restriction and file with MDNR.	Recording fee is low.	Site is currently zoned heavy industrial. Location in 100-year floodplain restricts construction under existing City of Kansas City, Missouri ordinances. The aquifer underlying the Facility is not currently utilized as a source of water.

Table 3-3
Source Control Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Cap	Contaminants are covered. Cover limits infiltration, promotes effective drainage, and prevents direct-contact of contaminants with potential receptors.	Contingent on regular maintenance.	Relatively easy to implement. Construction is performed using common equipment and materials. Surface caps are currently in place at SWMUs 2, 3, and 5.	Low to Moderate	Requires regular inspection and maintenance.
Constructed Barriers	Vertical barrier installed into the subsurface to minimize the migration of groundwater contamination. Examples are slurry walls, grout curtains, sheet piling, and synthetic sheeting.	Dependent on permeability, resistance to deterioration, and imperfections of barrier. Unfavorable for highly reactive contaminants and in expansive soils.	Most favorable when groundwater <20 feet and aquitard within 40 feet of ground surface. Sheet piling is currently in place along the paved portion of the Blue River in the SWMUs 17 and 33 area.	Moderate to High	
Surface Contouring	Surface grading/contouring directs surface water runoff to minimize infiltration and ponding. Construction of drainage swales, berms, and/or ditches are examples.	Well maintained features are effective at intercepting, diverting, and routing surface water away from contaminated areas.	Often used in conjunction with caps. Relatively easy to implement. Construction is performed using common equipment and materials. Surface contouring has already been performed for SWMUs 2, 3, and 5.	Low to Moderate	Requires regular inspection and maintenance.

Table 3-4
Ex-Situ Soil Treatment Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Solidification/ Stabilization	Solidification/stabilization reduces the mobility of hazardous substances and contaminants in the environment through both physical and chemical means. Contaminants are physically bound or enclosed within a solidified mass (solidification), and/or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Generally effective for metals and some organics. Soil may require pretreatment for VOCs. Generally not recommended for sludges or extremely oily soils.	Technology is offered by numerous vendors. Bench or pilot tests are needed.	Moderate to High. Capital intensive.	Ex-situ treatment solid residuals are commonly disposed off-site.
Off-Site Landfilling	Contaminated materials are removed and transported to a permitted treatment and disposal facility.	Effectiveness is dependent on long-term management of disposed wastes.	Approval from landfill and regulatory agency is required.	Moderate to High	Concern regarding long-term liabilities.

Table 3-5
In-Situ Soil Treatment Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Soil Vapor Extraction	Vacuum is applied through extraction wells to create a pressure/concentration gradient that induces gas-phase volatiles to be removed from soil through extraction wells. Also known as in-situ soil venting, in-situ volatilization, enhanced volatilization, or soil vacuum extraction.	Dependent on Henry's Law Constant of contaminant, moisture content, and air permeability of soil. Effective on VOCs and some fuels. Low permeability surface cap will enhance performance.	Field pilot study required. May require permitting. Successful pilot test conducted at SWMU 33.	Low to Moderate. Capital and O&M intensive.	Not effective for treatment of inorganics. Soil with a high percentage of fines and degree of saturation will require higher vacuum (higher cost).
Solidification/ Stabilization	Solidification/stabilization reduces the mobility of hazardous substances and contaminants in the environment through both physical and chemical means. Contaminants are physically bound or enclosed within a solidified mass (solidification), and/or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Generally effective for metals and some organics. Soil may require pretreatment for VOCs. Generally not recommended for sludges or extremely oily soils.	Technology is offered by numerous vendors. Bench or pilot tests are needed.	Moderate to High. Capital intensive.	In-situ treatment can be limited by depth of contaminants and solidified materials may hinder future site use.
Chemical Oxidation / Reduction	Oxidizing or Reducing compounds are introduced into the subsurface, usually by chemical injection. In chlorinated solvents, carbon-chlorine bonds are attacked thereby causing degradation.	Dependent on subsurface geology (reduced effectiveness in low permeability materials without fracturing, etc.). May require mulitple treatment applications. Target compounds are VOCs.	Pilot studies are needed. May require permitting. Equipment and materials are readily available.	Moderate	Heterogeneity and low permeability may cause some soil zones to be relatively unaffected.

Table 3-6
Groundwater Treatment Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Long-Term Monitoring	Groundwater monitoring and analysis program used to identify changes in groudnwater flow patterns, contamiant levels, and contaminant plume migration.	Assesses the potential impact of contaminants on identified receptors. Does not reduce contaminnat level or control contaminant migration.	Equipment and materials are readily available.	Low to Moderate	Can be used in combination with other treatment technologies.
Monitored Natural Attenuation with Source Control	Natural biological, chemical, and physical processes such as dispersion, volatilization, dilution, adsorption, and biodegradation reduce contaminant concentrations to acceptable levels.	Dependent on site conditions. Target contaminants are VOCs, SVOCs, and fuel hydrocarbons.	Requires modeling / evaluation of contaminant degradation rates, pathways, concentration(s) at receptor points.	Low to Moderate	Continuous monitoring until cleanup levels achieved.
Enhanced Bioremediation	Microorganisms or nutrients are introduced into the subsurface to increase degradation of organics by indigenous microbes, either aerobically or anaerobically.	Dependent on subsurface aquifer chemistry and geology (reduced effectiveness in low permeability materials without fracturing, etc.). May require mulitple treatment applications. Target contaminants are VOCs and fuel hydrocarbons.	Pilot studies are needed. May require permitting. Equipment and materials are readily available.	Moderate	Heterogeneity and low permeability may cause some soil zones to be relatively unaffected.
Chemical Oxidation / Reduction	Oxidizing or Reducing compounds are introduced into the subsurface, usually by chemical injection. In chlorinated solvents, carbon-chlorine bonds are attacked thereby causing degradation.	Dependent on subsurface chemistry and geology (reduced effectiveness in low permeability materials without fracturing, etc.). May require mulitple treatment applications. Targert compounds are VOCs.	Pilot studies are needed. May require permitting. Equipment and materials are readily available.	Moderate	Heterogeneity and low permeability may cause some soil zones to be relatively unaffected.
Air Sparging	Air is injected horizontally and vertically through a contaminated aquifer to remove contaminants by volatilization. A vapor extraction system is used to collect vapors from the vadose zone for treatment.	Dependent on subsurface geology (reduced effectiveness in low permeability materials). May enhance aerobic bioremediation of contaminants. Target contaminants are VOCs and fuels.	Pilot studies are needed. May require permitting. Unfavorable in low permeability aquifers.	Moderate	Soil heterogeneity may cause some soil zones to be relatively unaffected. Has potential to spread contamination.

Table 3-6
Groundwater Treatment Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Fluid Vapor Extraction (Dual Phase Extraction)	A high vacuum system is applied to simultaneously remove liquid and gas from low permeability or heterogeneous formations. Lowers water table exposing vadose zone for more efficient SVE.	More effective than SVE for heterogeneous clays and fine sands. Typically used in vadose zone soils with permeability range of 10E-08 to 10E-03 cm/s.	Pilot studies are needed. May require permitting. Equipment and materials are readily available.	Moderate	May need to treat extracted water prior to discharge.

FIGURES

LEGEND:

AK STEEL PROPERTY BOUNDARY

NORTH

0 2000' 4000'

SCALE IN FEET

Burns & McDonnell SINCE 1898

Figure 1-1

FACILITY LOCATION MAP
AK STEEL
KANSAS CITY, MISSOURI

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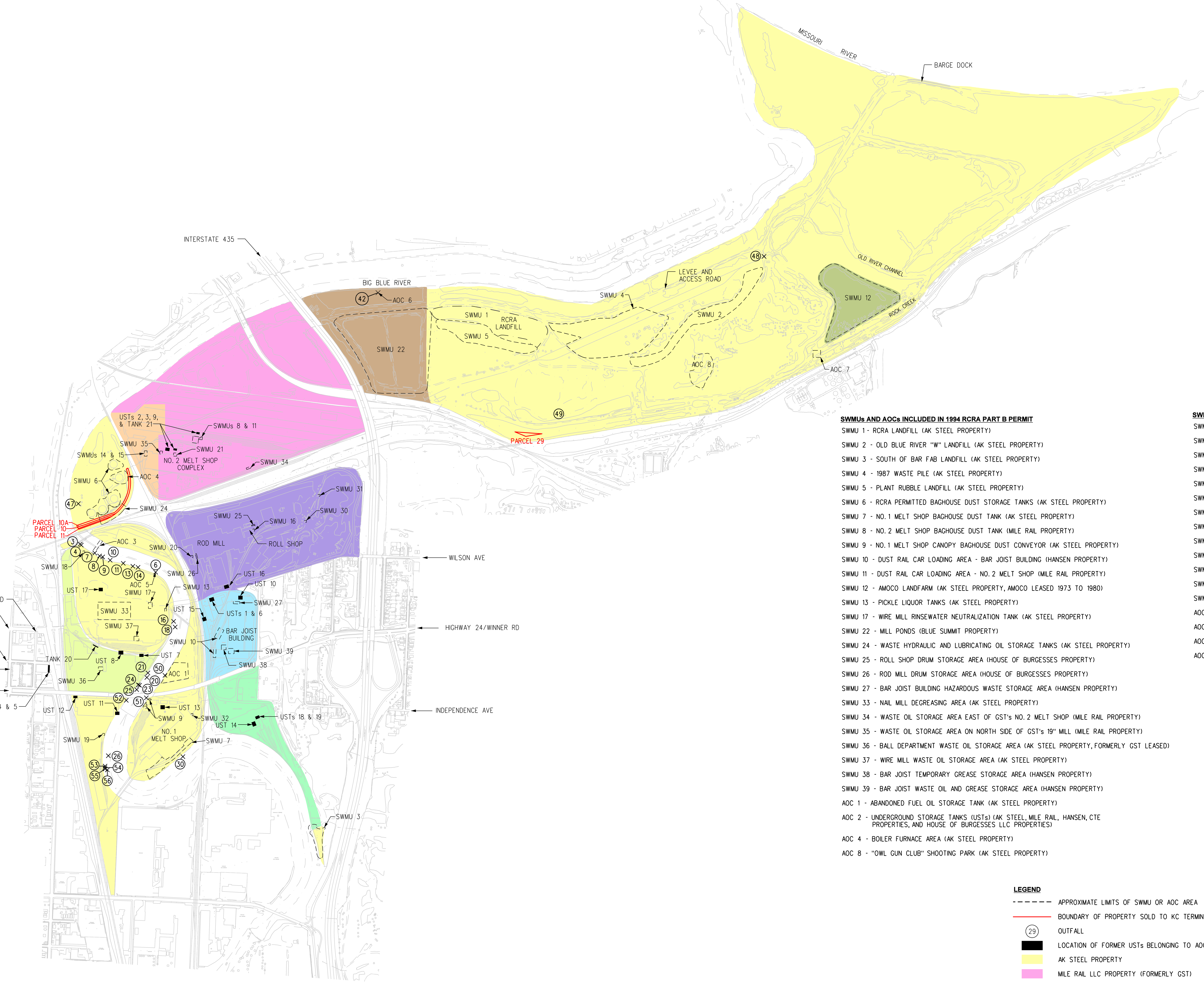


SWMUs AND AOCs INCLUDED IN 1994 RCRA PART B PERMIT

SWMU 1 - RCRA LANDFILL (AK STEEL PROPERTY)
SWMU 2 - OLD BLUE RIVER "W" LANDFILL (AK STEEL PROPERTY)
SWMU 3 - SOUTH OF BAR FAB LANDFILL (AK STEEL PROPERTY)
SWMU 4 - 1987 WASTE PILE (AK STEEL PROPERTY)
SWMU 5 - PLANT RUBBLE LANDFILL (AK STEEL PROPERTY)
SWMU 6 - RCRA PERMITTED BAGHOUSE DUST STORAGE TANKS (AK STEEL PROPERTY)
SWMU 7 - NO. 1 MELT SHOP BAGHOUSE DUST TANK (AK STEEL PROPERTY)
SWMU 8 - NO. 2 MELT SHOP BAGHOUSE DUST TANK (MILE RAIL PROPERTY)
SWMU 9 - NO. 1 MELT SHOP CANOPY BAGHOUSE DUST CONVEYOR (AK STEEL PROPERTY)
SWMU 10 - DUST RAIL CAR LOADING AREA - BAR JOIST BUILDING (HANSEN PROPERTY)
SWMU 11 - DUST RAIL CAR LOADING AREA - NO. 2 MELT SHOP (MILE RAIL PROPERTY)
SWMU 12 - AMOCO LANDFARM (AK STEEL PROPERTY, AMOCO LEASED 1973 TO 1980)
SWMU 13 - PICKLE LIQUOR TANKS (AK STEEL PROPERTY)
SWMU 17 - WIRE MILL RINSEWATER NEUTRALIZATION TANK (AK STEEL PROPERTY)
SWMU 22 - MILL PONDS (BLUE SUMMIT PROPERTY)
SWMU 24 - WASTE HYDRAULIC AND LUBRICATING OIL STORAGE TANKS (AK STEEL PROPERTY)
SWMU 25 - ROLL SHOP DRUM STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 26 - ROD MILL DRUM STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 27 - BAR JOIST BUILDING HAZARDOUS WASTE STORAGE AREA (HANSEN PROPERTY)
SWMU 33 - NAIL MILL DEGREASING AREA (AK STEEL PROPERTY)
SWMU 34 - WASTE OIL STORAGE AREA EAST OF GST's NO. 2 MELT SHOP (MILE RAIL PROPERTY)
SWMU 35 - WASTE OIL STORAGE AREA ON NORTH SIDE OF GST's 19" MILL (MILE RAIL PROPERTY)
SWMU 36 - BALL DEPARTMENT WASTE OIL STORAGE AREA (AK STEEL PROPERTY, FORMERLY GST LEASED)
SWMU 37 - WIRE MILL WASTE OIL STORAGE AREA (AK STEEL PROPERTY)
SWMU 38 - BAR JOIST TEMPORARY GREASE STORAGE AREA (HANSEN PROPERTY)
SWMU 39 - BAR JOIST WASTE OIL AND GREASE STORAGE AREA (HANSEN PROPERTY)
AOC 1 - ABANDONED FUEL OIL STORAGE TANK (AK STEEL PROPERTY)
AOC 2 - UNDERGROUND STORAGE TANKS (USTs) (AK STEEL, MILE RAIL, HANSEN, CTE PROPERTIES, AND HOUSE OF BURGESSES LLC PROPERTIES)
AOC 4 - BOILER FURNACE AREA (AK STEEL PROPERTY)
AOC 8 - "OWL GUN CLUB" SHOOTING PARK (AK STEEL PROPERTY)

SWMUs AND AOCs NOT INCLUDED IN 1994 RCRA PART B PERMIT

SWMU 14 - ETCH LAB MIXING TANK (ONESTEEL PROPERTY)
SWMU 15 - ETCH LAB HOLDING TANK (ONESTEEL PROPERTY)
SWMU 16 - ROLL SHOP ROLL CLEANING TANK (HOUSE OF BURGESSES PROPERTY)
SWMU 18 - BLOOMING MILL SCALE PIT (AK STEEL PROPERTY)
SWMU 19 - TWELVE INCH (12") MILL SCALE PIT (AK STEEL PROPERTY)
SWMU 20 - ROD MILL SCALE PIT (HOUSE OF BURGESSES PROPERTY)
SWMU 21 - NO. 2 MELT SHOP SCALE PIT (MILE RAIL PROPERTY)
SWMU 23 - SAFETY-KLEEN UNITS
SWMU 28 - OUTSIDE HAZARDOUS WASTE STORAGE AREA
SWMU 29 - MAIN SUBSTATION PCB STORAGE AREA
SWMU 30 - LONG TRACTOR SHED PCB STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 31 - SMALL TRACTOR SHED PCB STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 32 - NO. 1 MELT SHOP PCB STORAGE AREA (AK STEEL PROPERTY)
AOC 3 - ARMCO DAM/PCB EXCAVATION AREA OF BLUE RIVER (AK STEEL PROPERTY)
AOC 5 - OUTFALL NO. 006 (AK STEEL PROPERTY)
AOC 6 - OUTFALL NO. 042 (BLUE SUMMIT PROPERTY)
AOC 7 - BACKWASH AREA OF ROCK CREEK (AK STEEL PROPERTY)

LEGEND

- APPROXIMATE LIMITS OF SWMU OR AOC AREA
- BOUNDARY OF PROPERTY SOLD TO KC TERMINAL RAILROAD
- 29 OUTFALL
- LOCATION OF FORMER USTs BELONGING TO AOC 2
- AK STEEL PROPERTY
- MILE RAIL LLC PROPERTY (FORMERLY GST)
- AK STEEL PROPERTY FORMERLY LEASED TO GST
- AK STEEL PROPERTY FORMERLY LEASED TO AMOCO
- HANSEN PROPERTY DEVELOPMENT, INC. (FORMERLY GST) D.B.A. U-PICK-IT OF KANSAS CITY
- HOUSE OF BURGESSES LLC PROPERTY (FORMERLY GST) D.B.A. MIDWEST SCRAP MANAGEMENT
- CTE PROPERTIES LLC PROPERTY (FORMERLY GST) D.B.A. CUSTOM TRUCK & EQUIPMENT
- ONE STEEL GRINDING SYSTEMS LLC PROPERTY (FORMERLY GST)
- BLUE SUMMIT LLC (FORMERLY GST)

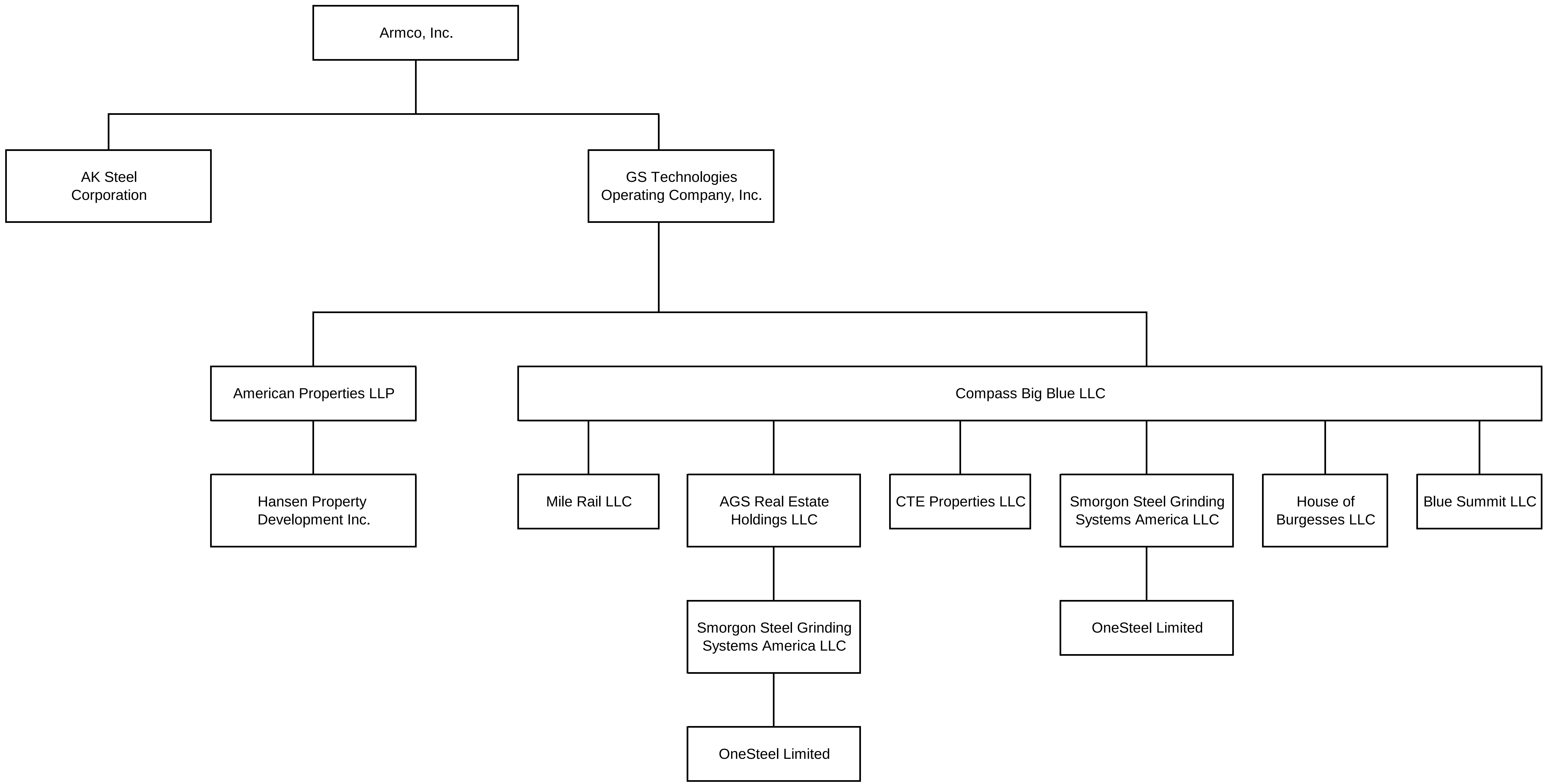
NOTES:

1. APPROXIMATE FACILITY BOUNDARY, AS DEFINED IN PERMIT, IS SHOWN. AS INDICATED, PORTIONS OF THE FACILITY ARE NO LONGER OWNED BY AK STEEL.
2. AREAS HISTORICALLY DECOMMISSIONED AND DEMOLISHED: NO. 1 MELT SHOP, ROD MILL, ROLL SHOP, AND NO. 2 MELT SHOP.
3. LOCATIONS OF SWMUS 23, 28, AND 29 ARE UNKNOWN.
4. LOCATIONS OF SWMUS AND AOCS NOT INCLUDED IN THE 1994 RCRA PART B PERMIT ARE APPROXIMATE AND NOT BASED ON SURVEY INFORMATION. THE LOCATIONS OF THESE SWMUS AND AOCS ARE BASED UPON FIGURE 6 OF THE RCRA FACILITY ASSESSMENT (TETRA TECH, 1992).

Burns & McDonnell

Figure 1-2
FACILITY MAP

AK STEEL KANSAS CITY FACILITY



Note: Ownership based on search of Jackson County, Missouri online public records (http://records.co.jackson.mo.us/localization/menu.asp).
Most recent Warranty Deed was dated December 9, 2010 (CBB to Mile Rail LLC). All CBB tracts have been sold.
American Grinding Systems (AGS) was sold to Smorgon Steel in October 2004, and Smorgon Steel merged with OneSteel Limited in August 2007.

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Figure 1-3

Ownership Status

AK Steel Kansas City Facility

Organizational Chart

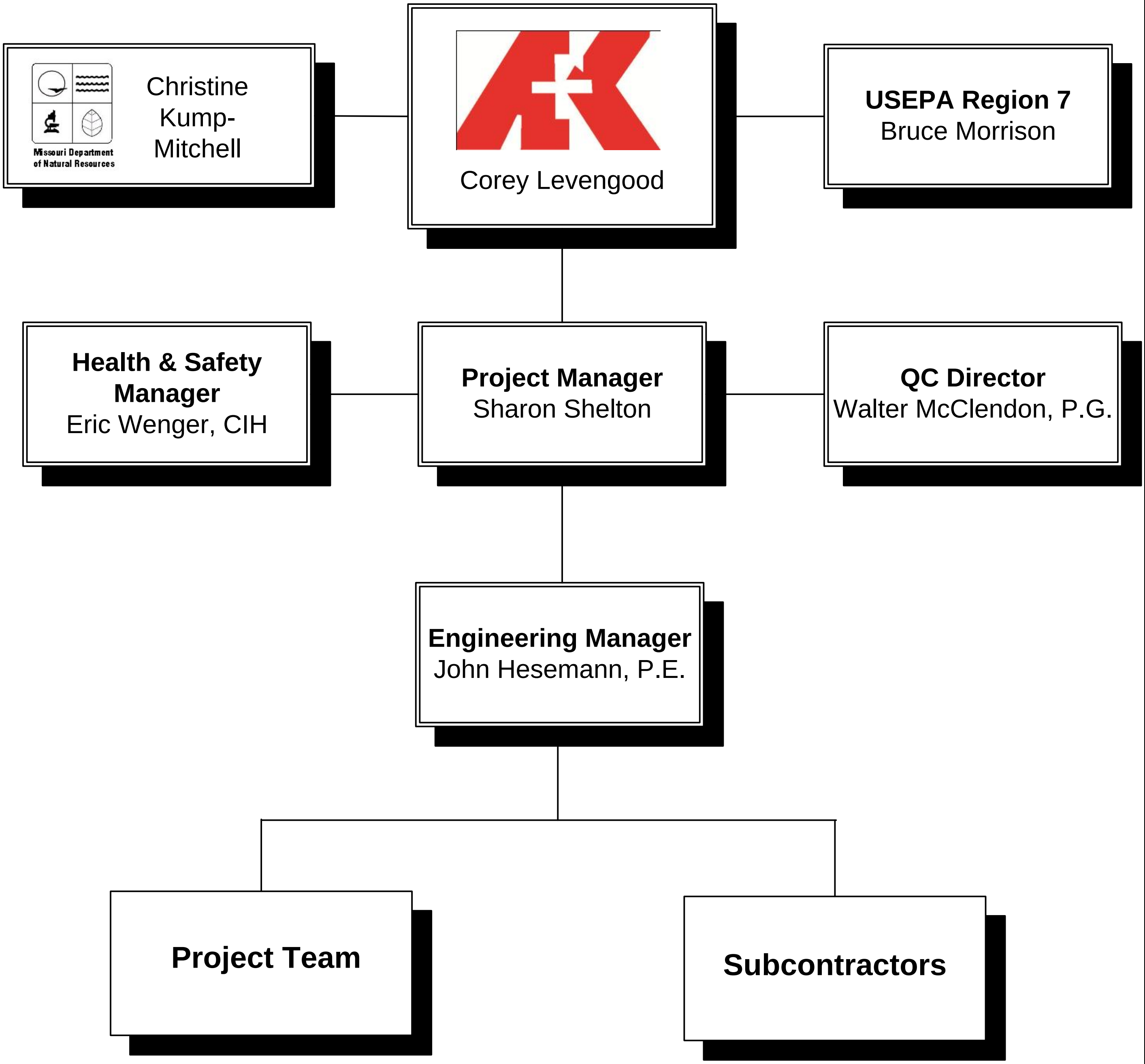

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Figure 7-1
Organizational Chart
AK Steel
Kansas City Facility

AK Steel Corporation
Environmental Affairs
9227 Centre Pointe Drive
West Chester, Ohio 45069

September 17, 2012

Bruce Morrison, Project Manager
Waste Remediation and Permitting Branch
Air and Waste Management Division
United States Environmental Protection Agency - Region VII
901 North 5th Street
Kansas City, KS 66101

Re: HSWA Corrective Action Permit Number MOD 007 118 029
Final Corrective Measures Study Work Plan for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 14, and 33; and AOCs 1, 4, and 8
AK Steel, Kansas City, Missouri

Dear Mr. Morrison:

AK Steel is submitting to the United States Environmental Protection Agency (USEPA) and the Missouri Department of Natural Resources (MDNR) the *Final Corrective Measures Study Work Plan for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 14, and 33; and AOCs 1, 4, and 8,* which was prepared by Burns & McDonnell Engineering Company, Inc. (BMcD) at our direction. This report is in response to USEPA's August 27, 2012 "Approval of Response to Comments on the Draft Corrective Measures Study (CMS) Work Plan." Comments were incorporated as outlined below:

Comment	Response Location
Comment #1	Table 2-1 was split into separate tables for the soil screening west of I-435 (Table 2-1) and soil screening east of I-435 (Table 2-2). The USEPA Regional Screening Level (RSL) for residential soil was incorporated into these tables.
Comment #2	Table 2-1 was split into separate tables for the soil screening west of I-435 (Table 2-1) and soil screening east of I-435 (Table 2-2). The USEPA Region 5 ecological soil screening levels were incorporated into Table 2-2.
Comment #3	Table 2-1 was revised to include screening levels for elemental mercury.
Comment #4	The introductory paragraph for Section 2.2 was revised to indicate that the screening process does not apply to SWMUs 2, 3, and 5 where solid waste remains on site in capped landfills.
Comment #5	Section 2.2.1 was revised to include subsections for soil screening applicable to areas West of I-435 and East of I-435.
Comment #6	Section 2.2.2 was revised to include evaluation of cumulative effects to the groundwater screening process. Table 2-2 was updated to Table 2-3 to reflect changes to the soil screening tables noted previously.

Comment	Response Location
Comment #7	Section 2.3 SWMU and AOC Investigation Summary and Preliminary Screening and associated appendices were removed from the CMS Work Plan. The remaining subsections within Section 2 were renumbered accordingly.
Comment #8	Section 2.4 (Section 2.3 after revision) was revised to reflect changes to the preliminary media cleanup standards consistent with data screening changes in Sections 2.2.1 and 2.2.2.
Comment #9	Section 2.5 (Section 2.4 after revision) was revised to indicate that the points of compliance for contamination within groundwater are expected to be the downgradient boundary of the SWMU or AOC.

CERTIFICATION:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

This Report and Certification are submitted on behalf of AK Steel Corporation.

Very truly yours,

James C. Levengood
Corporate Manager of Environmental Affairs

cc: B. Morrison – USEPA Region 7 (2 Copies)
C. Kump-Mitchell – MDNR (1 Copy)
B. Stuart – MDNR (2 Copies)
C. Batliner – AK Steel
S. L. Shelton – Burns & McDonnell

FINAL
CORRECTIVE MEASURES STUDY WORK PLAN
for
SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33; and AOCs 1, 4, and 8
AK STEEL
KANSAS CITY, MISSOURI

EPA ID# MOD007118029

September 2012

Prepared for

AK Steel

Burns & McDonnell Project No. 67873
Burns & McDonnell Engineering Company
Engineers-Architects-Consultants
Kansas City, Missouri

TABLE OF CONTENTS

LIST OF ACRONYMS

American	American Properties, LLP
AOC	area of concern
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
BMcD	Burns & McDonnell Engineering Company, Inc.
BMWCI	Burns & McDonnell Waste Consultants, Inc.
CAO	Corrective Action Objective
CCB	Compass Big Blue, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienist
CFR	Code of Federal Regulations
CMS	Corrective Measure Study
DCE	dichloroethene
DPE	Dual Phase Extraction
Facility	AK Steel, 7000 Winner Road, Kansas City, Missouri
GST	GST Technologies Operating Co., Inc.
Hansen	Hansen Property Development, Inc.
HASP	Health and Safety Plan
HSM	Health and Safety Manager
HSWA	Hazardous and Solid Waste Amendments
I-435	Interstate 435
KCT	Kansas City Terminal Railway Company
LLC	Limited Liability Company
LTM	long term monitoring
MCL	maximum contaminant level
MDNR	Missouri Department of Natural Resources
mg/kg	milligrams per kilogram
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PE	Professional Engineer
Permit	HSWA Part B Post Closure Permit
PG	Professional Geologist
pH	hydrogen ion potential
PRG	Preliminary Remediation Goal

DOCUMENT DISTRIBUTION

USEPA Region 7, Bruce Morrison, Project Manager – 2 copies

Missouri Department of Natural Resources, Christine Kump-Mitchell, Project Manager – 1 copy

Missouri Department of Natural Resources, Bruce Stuart, Sr. Technical Advisor – 2 copies

AK Steel, Cory Levengood – 1 copy

AK Steel, Carl Batliner – 1 copy

Burns & McDonnell Engineering Company, Inc., Sharon Shelton – 2 copies

* * * * *

1.0 INTRODUCTION

Burns & McDonnell Engineering Company, Inc. (BMcD) has prepared this Corrective Measures Study (CMS) Work Plan on behalf of AK Steel (former Armco Inc.[1]) to describe the general approach for determining areas that require active remediation, defining corrective action objectives, and investigating/evaluating potential remedies. AK Steel previously conducted a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and a Supplemental Investigation at the AK Steel Facility, Kansas City, Missouri (Facility) to satisfy the "Special Permit Conditions" presented in Part II of AK Steel's Hazardous and Solid Waste Amendments (HSWA) Part B Post-Closure Permit (Permit), which was issued by the United States Environmental Protection Agency (USEPA) Region 7 on November 30, 1994 (USEPA ID# MOD 007118029). The results of these investigations were summarized in the *RCRA Facility Investigation Report, Armco Kansas City Facility* (RFI Report) (Burns & McDonnell Waste Consultants, Inc. [BMWCI], 1999) and *Supplemental Investigation Report, AK Steel, Kansas City, Missouri* (BMcD, 2008). The USEPA and Missouri Department of Natural Resources (MDNR) have approved both of these documents in combination to satisfy Special Permit Condition XXX presented in Part II of the Permit.

1.1 PURPOSE AND SCOPE

In accordance with Section XXXII of Part II of the Permit and in response to USEPA's April 12, 2012 "Notice to Conduct a Corrective Measures Study," AK Steel is submitting this CMS Work Plan for Solid Waste Management Units (SWMUs) 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33; and Areas of Concern (AOCs) 1, 4, and 8. This document describes the general approach for determining areas that require active remediation, defining corrective action objectives, and investigating/evaluating potential remedies. It also describes remedies preliminarily identified for evaluation during the CMS. As defined in the "Notice to Conduct a Corrective Measures Study," the scope of this report includes the following SWMUs and AOCs that are located on AK Steel property:

- SWMU 2 – Old Blue River "W" Landfill
- SWMU 3 – South of Bar Fab Landfill

[1] Effective September 30, 1999, Armco Inc. was merged with and into AK Steel Corporation, a Delaware Corporation with headquarters in West Chester, Ohio.

Melt Shop in the mid 1950s and early to late 1960s, for a total of four electric arc furnaces. In 1959, production of steel in open-hearth furnaces was discontinued, and the open-hearth furnaces were later demolished.

Steel ingots produced in both open-hearth and electric arc furnaces were rolled in the 32" Blooming Mill and 18" Rolling Mill to produce billets that were primarily used as feed stock for other plant operations. The 12" Merchant Bar Mill was built and began production in the early 1950s to supplement the 10" Finishing Mill. In 1957, the Rod Mill was built and placed in operation.

A second melt shop complex was built and placed in operation in 1976. The complex included the No. 2 Melt Shop (with two additional electric arc furnaces), a continuous caster, and a 19" Rolling Mill. By 1977, Armco's Kansas City steel production operations included six electric arc furnaces in two melt shops, a blooming mill, and a continuous caster. A multitude of semi-finished and finished products were produced by the 19" Rolling Mill, the 12" Finishing Mill, the Rod Mill, the Wire Mill, the Nail Mill, the Bolt and Nut Plant, and the Grinding Media Facility. A ladle arc refining facility was added to the No. 2 Melt Shop operation in 1989. Economic conditions in the steel industry affected Armco's Kansas City plant, and the diversity of operations was slowly reduced.

By 1993, Armco's Kansas City plant had continued to grow in production tonnage, but production was limited to semi-finished steel products and a minor amount of finished steel products. Historically, the plant operations and property owned by Armco (now AK Steel) totaled approximately 860 acres. Production facilities and a portion of the plant real estate were sold to GST Technologies Operating Company, Inc. (GST), which was doing business as GST Steel Company, on November 12, 1993. Armco retained ownership of approximately 560 acres, of which GST leased approximately 100 acres. GST operated facilities on this property until they filed for bankruptcy in April 2001. There are no active manufacturing operations or activities on the AK Steel property. As part of the bankruptcy proceedings, GST sold the majority of their holdings to Compass Big Blue LLC (CBB).

In the intervening years, the CBB tracts have been sold to House of Burgesses LLC, CTE Properties LLC, Smorgon Steel Grinding Systems LLC[2], Blue Summit LLC, and/or Mile Rail LLC. Businesses currently operating on these former CBB parcels include:

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[2] Smorgon Steel Grinding Systems LLC merged with OneSteel Limited in August 2007. Moly-Cop Grinding Media, a division of OneSteel, currently operates this parcel.

1.3 CMS WORK PLAN ORGANIZATION

This CMS has been prepared by BMcD and consists of one volume. This document is organized as follows:

- Section 1.0 – Introduction
- Section 2.0 – CMS Objectives
- Section 3.0 – CMS Alternatives
- Section 4.0 – Evaluation of Corrective Measures
- Section 5.0 – Pilot, Laboratory, and/or Bench Scale Studies
- Section 6.0 – CMS Report Outline
- Section 7.0 – Project Management
- Section 8.0 – References
- Tables
- Figures

*****

2.0 CMS OBJECTIVES

The overall objective of the CMS is to mitigate potential current and future risks to human health and the environment. The following section provides relevant background information for SWMUs 2, 3, 4, 5, 6, 7, 12, 13, 17, 24, and 33 and AOCs 1, 4, and 8; discussion of the screening process that will be used to determine the need for additional remediation at a SWMU or AOC; a preliminary comparison of SWMU and AOC investigation data to the screening levels; and, a description of the process that will be used to establish media cleanup standards and points of compliance.

2.1 HISTORY OF SWMUS AND AOCS INCLUDED IN THE CMS

2.1.1 SWMUs/AOCs on Property East of I-435

2.1.1.1 SWMU 2 – Old Blue River "W" Landfill

The Old Blue River "W" Landfill (SWMU 2) is a closed landfill previously used to manage emission control dust and solid waste. This W-shaped portion of the Old Blue River channel was used to dispose of emission control dust generated in the No. 1 and No. 2 Melt Shop electric arc furnaces from approximately 1965 until 1980. In addition, general plant and office trash was disposed in this SWMU. SWMU 2 covers an area of approximately 7 acres and is estimated to contain 185,000 cubic yards of material. The landfill was closed through construction of a soil cap (approximately three feet of compacted soil and a vegetative (fescue grass) cover. SWMU 2 is regularly mowed and inspected as a closed landfill. This site has been classified as a Class 4 Site on the Missouri Registry of Confirmed Abandoned or Uncontrolled Sites. Class 4 is defined as "sites that have been previously closed and require continued management" (MDNR, 2011).

2.1.1.2 SWMU 4 – 1987 Waste Pile

The 1987 Waste Pile (SWMU 4) consisted of a pile of emission control dust that was discovered in 1987 near the Old Blue River "W" Landfill (SWMU 2). The estimated quantity of emission control dust (i.e., K061 dust) in the waste pile was 14,000 cubic yards. It is not known how long the pile was in existence. In 1988, the waste pile was transported off site for reclamation and manifested as emission control dust. The original defined SWMU area was approximately 1.5 acres in size; however, during the RFI, the soil contamination in the SWMU 4 area expanded in size to the west and south to encompass nearly 16 acres.

2.1.1.3 SWMU 5 – Plant Rubble Landfill

The Plant Rubble Landfill (SWMU 5) is a landfill which was used by Armco from 1980 to 1993 to manage rubble and demolition materials. The landfill was capped and subsequently vegetated (fescue codes K048, K049, K050, and K051 (Helffrich, 1981). The basis for the listing of these waste codes is the presence of lead and hexavalent chromium. At the time that the petroleum refining waste was managed at SWMU 12, it was not classified as hazardous waste. Samples taken from sludge-incorporated soil passed the EP-Toxicity testing for chromium and lead (WCC, 1980).

In November 1998, Armco personnel observed deterioration of the dike located around SWMU 12. Armco and BMWCI personnel performed an engineering evaluation of the dike failure. A slope failure occurred on the southern portion of the dike, directly north of the relocated Rock Creek and the Independence Sewage Treatment Plant outfall location. The failure was approximately 140 feet long and extended back into the bank approximately 40 feet from the toe of the slope at its deepest point. It appeared that the failure was a result of extensive erosion on the supporting toe of the slope and scouring of the dike due to Rock Creek flow combined with discharge from the Sewage Treatment Plant outfall. Based on the site evaluation, it did not appear that contents of the SWMU were released due to this condition. USEPA was notified of these conditions in Armco's Fourth Quarter 1998 Progress Report dated January 11, 1999. ThermoRetec Corporation completed repairs to the levee in November 1999.

SWMU 12 is currently heavily vegetated with various brush and trees. A portion of SWMU 12 in is the right-of-way for a planned roadway, the Lewis and Clark Expressway. The conceptual design for this roadway has been completed.

2.1.1.5 AOC 8 – "Owl Gun Club" Shooting Park

AOC 8 (see Figure 1-2), was a clay pigeon shooting park known as the "Owl Gun Club" which was located south of the Old Blue River "W" Landfill (SWMU 2) and immediately north of Rock Creek. The specific dates of operation of the Owl Gun Club are unknown. From a review of aerial photos, the AOC first becomes visible in 1955 and is no longer visible in 1974. Prior to use of the shooting range, the area was used for agriculture. Stationing posts and two trap buildings are visible on a 1955 aerial photograph. The western trap building is no longer present by 1964. By 1974, all evidence of the shooting range has been removed, and the area was again used for agriculture. Because little information is available about the dates the gun club was active or the amount of activity at the club, it is not possible to estimate how much lead shot might be present. The original defined AOC area was approximately 2.5 acres in size. During the RFI, the AOC 8 area expanded in size, primarily to the north, to approximately 6 acres.

In October 1998, an oil sheen on the adjacent Blue River was traced to this location. The sheen was discovered by United States Army Corps of Engineers (USACE) personnel who were working along the river. Investigation activities were undertaken to determine the condition of the AST area and to determine if petroleum contamination was present between the tank site and the river. From November 1988 through January 1989, the USACE collected soil samples from the eastern bank of the Big Blue River. In 1988 and 1989, soil samples collected by the USACE had total recoverable petroleum hydrocarbons (TRPH) ranging from 38 to 728 milligrams per kilogram (mg/kg) and oil and grease ranging from 76 to 9,505 mg/kg. Polychlorinated biphenyls (PCBs) were not detected (< 1 mg/kg), and VOCs were not detected (< 1 mg/kg) except for one sample that had a total volatile organic compound (VOC) concentration of 12.5 mg/kg (Remcor, 1989).

A Preliminary Site Investigation completed in 1989 by Remcor indicated the following:

- Borings drilled in the oil unloading platform encountered mill scale fill overlying aggregate fill overlying alluvium. The mill scale fill had oil and grease concentrations less than 1,000 mg/kg. Oil and grease concentrations in the aggregate fill ranged from 53 to 7,700 mg/kg. One soil sample was collected from the alluvium and contained 53 mg/kg oil and grease.

- Borings drilled in the river bank were logged as aggregate fill over alluvium. Free product was observed on the water table in this area. Remcor concluded that the source for the petroleum hydrocarbons was the oil unloading platform area. Soil samples had oil and grease concentrations ranging from nondetect to 4,300 mg/kg.

Based upon the investigation, a recovery well, two observation wells, and one observation piezometer were installed at the site. Armco began recovering petroleum hydrocarbons and water from the recovery well in 1991. Recovery activities ceased in the fall of 1991 because petroleum hydrocarbons were no longer present in the wells (Remcor, 1991).

2.1.4 SWMUs/AOCs at the Former Tank Farm

The former Tank Farm is located directly north of the Kansas City Terminal Railway Company (KCT) Railroad flyover bridge on the east side of the Blue River. SWMU 6, AOC 4, and SWMU 24 are located adjacent to each other in this area. SWMU 6 includes the area surrounding the locations of former Tanks 1, 2, 3, and 5, and AOC 4 includes the area surrounding former Tank 4. SWMU 24 was located in a depression between Tanks 2 and 3. Due to their proximity, they are presented together in this section for ease of understanding. The combined area of SWMU 6, AOC 4, and SWMU 24 is approximately 4 acres.

time, waste oil accumulated at SWMU 24 and was pumped to Tank No. 4 for inclusion in the fuel oil. This practice was performed until 1991 when Armco began transporting waste oil off site for fuel blending. In 1993, the boilers were shut down and the transfer of fuel oil from Tank 4 to the boiler house ceased. The associated equipment was thoroughly cleaned in 1994.

Various records indicate that for a brief time in the 1980s, 1,1,1-trichloroethane (1,1,1-TCA) may have been mixed into the waste oil and subsequently mixed with the fuel oil and utilized in the boiler furnaces. Since there was no mechanism at the boiler furnaces to incorporate the addition of any material to the fuel oil supply, AOC 4 was defined as Tank No. 4, which is where waste oil would have been added into the fuel oil that supplied the boiler furnaces.

2.1.4.3 SWMU 24 – Waste Hydraulic Lubricating Oil Storage Tanks

The former Waste Hydraulic and Lubricating Oil Storage Tanks (SWMU 24), located on AK Steel and KCT property (Figure 1-2), functioned between 1975 and 1993 as a waste oil collection system for the entire Facility. Waste oil of various types was brought to the area in drummed containers or 600-gallon waste oil "tote boxes". Until 1991, the waste oil from SWMU 24 was incorporated into the heating oil supply; however, after November 1991, waste oil was sent off site for fuel blending. The defined SWMU area was approximately 1 acre in size.

When the SWMU was removed from service in 1993, its components were cleaned and subsequently dismantled and removed. The two ASTs at SWMU 24 were cut up and recycled in 1996. Various records indicated that for a brief time in the 1980s, 1,1,1-TCA might have been mixed into the waste oil, which was subsequently mixed with the fuel oil and utilized in the boiler furnaces (AOC 4). There was no mechanism at the Boiler Furnace Area to incorporate the addition of any material to the fuel oil supply. If 1,1,1-TCA was added to the fuel oil system, it most likely would have been added in the waste oil area.

As reported to USEPA and MDNR in a letter dated March 9, 1999, Armco sold a portion of its property, totaling less than one (1) acre, to KCT for construction of an overhead Railroad Bridge known as the Flyover Project to relieve transportation congestion and public safety issues in the area. This parcel of land contained a portion of SWMU 24. As part of the Flyover Project, the low-lying area at the center of SWMU 24 was partially filled by KCT.

2.1.5 SWMUs Associated with Nail Mill Degreaser VOC Plume

Prior to the RFI, historical investigations indicated the presence of a chlorinated VOC plume that centered on the former Nail Mill degreaser (SWMU 33). During the RFI, it became apparent that the chlorinated

The defined SWMU 13 area is less than 0.1 acre in size. In August 1998, modifications were made in the vicinity of SWMU 13 as Armco extended Wilson Avenue in an east-west direction. As part of this modification, various concrete basement walls near SWMU 13 were lowered below grade. The concrete from the walls and other imported aggregate materials were used to fill any voids in the subsurface. At present, the surface materials consist of slag, other aggregate, and the remnants of building foundations. There is no surface soil, per se, at this location.

2.1.5.2 SWMU 17 – Wire Mill Rinsewater Neutralization Tank

The Wire Mill Rinsewater Neutralization Tank (SWMU 17) consisted of an open-topped 18,000-gallon concrete in ground storage tank (UST) with an acid-proof brick lining. During its operation, the tank received acid rinse waters from the hydrochloric acid wire cleaning operations and the sulfuric acid rod cleaning operations. The SWMU 17 tank was cleaned and closed in place in 1991 as part of the closure activities at the Wire Mill. The defined SWMU area is approximately 50 feet by 80 feet. In August 1998, modifications were made in the area as Wilson Avenue was extended in an east-west direction across the west of SWMU 17. As part of this modification, the concrete walls of SWMU 17 were lowered, and the concrete from the walls and other imported aggregate materials were used to fill the void left by the former tank. At present, the surface materials consist of slag, other aggregate, and the remnants of building foundations. There is no surface soil, per se, at this location.

2.1.5.3 SWMU 33 – Nail Mill Degreasing Area

The Nail Mill Degreasing Area (SWMU 33) was used for the removal of residue during the production of nails. The degreasing operation was located in the northwest portion of the Nail Mill. The presence of chlorinated VOCs in the surrounding area was discovered and reported in 1991 while Armco was preparing for the closure and conversion of the mill into a warehouse. The nail mill was subsequently demolished and a wood block floor contaminated with trichloroethene (TCE) was removed and properly disposed. The Nail Mill Degreasing Area (SWMU 33) currently consists of rubble over the concrete floor of the former building. The defined SWMU 33 area is approximately 2.5 acres in size. At present, the surface materials consist of slag, other aggregate, and the remnants of concrete building foundations. There is no surface soil, per se, at this location.

2.2 PROPOSED SWMU AND AOC SCREENING PROCESS

A screening process was developed to determine the need for a particular SWMU or AOC to be carried forward as part of the CMS. This screening process does not apply to SWMUs 2, 3, and 5 where solid wastes remain in place within capped landfills. With these exceptions, screening will be conducted for both soil and groundwater as described in the following sections.

The decision process for screening the soil data will be as follows:

- Step 1: Soil data for each SWMU/AOC will be screened on a point by point basis. If the maximum detected concentration for a constituent within a SWMU/AOC exceeds its residential RSL, the constituent will be carried forward to the Step 2 of the decision process. As noted above, exceptions will be made for lead, which has a site-specific PRG, and for arsenic, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, which have background values higher than the residential RSLs. If the maximum detected concentration for a constituent does not exceed the screening criteria, then no further evaluation will be conducted for that constituent in the SWMU/AOC as part of the CMS.

- Step 2: If the maximum detected concentration of a constituent for a SWMU/AOC exceeds the screening level, then the SWMU/AOC will be carried forward for additional risk evaluation or move directly into evaluation of corrective measures alternatives. Additional risk evaluation will be performed in accordance with *Risk Assessment Guidance for Superfund, EPA/540/1-89-002* (USEPA, 1989) with any subsequent updates, amendments, or supplements. Soil contamination will be evaluated in accordance with *Soil Screening Guidance* (USEPA, 1996).

2.2.1.2 SWMUs and AOCs East of I-435

Manufacturing was not performed in parts of the Facility east of I-435. This area was primarily used for waste disposal in landfills (i.e., RCRA Landfill, SWMU 2, and SWMU 5) and landfarming (SWMU 12). For a brief period, the Facility had private rail lines that transferred materials and products to a barge dock on the Missouri River for shipment. The screening levels for this area are presented on Table 2-2 and include the following:

- USEPA RSL for residential soil (USEPA, 2012)

- USEPA Region 5 Ecological Screening Levels (USEPA, 2003)

- Blue Valley Industrial Corridor Background Values (USACE, 2003)

- Site-specific PRG for lead (USEPA, 2010)

The decision process for screening the soil data will be as follows:

- Step 1: Soil data for each SWMU/AOC will be screened on a point by point basis. The maximum detected concentration for a constituent within a SWMU/AOC will be compared to the

2.3 PROPOSED DEVELOPMENT OF MEDIA CLEANUP STANDARDS

Media cleanup standards are intended to meet requirements for protection of human health and the environment. Preliminary media cleanup standards for soil and groundwater include the screening criteria established in Section 2.2, which are summarized as follows:

- Soil – SWMUs and AOCs West of I-435: The preliminary media cleanup standards for SWMUs 6, 7, 13, 17, 24, and 33, and AOCs 1 and 4 are the USEPA RSLs for residential soil. Exceptions will be made for lead, which has a site-specific PRG and for arsenic, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, which have background values above the USEPA RSLs for residential soil.

- Soil – SWMUs and AOCs East of I-435: The preliminary media cleanup standards for SWMU 4, SWMU 12, and AOC 8 will be the lesser of the USEPA residential soil or the USEPA Region 5 ecological screening level. Exceptions will be made for lead, which has a site-specific PRG, and cadmium, chromium, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, which have background values above the USEPA Region 5 ecological screening levels and/or USEPA RSLs for residential soil.

- Groundwater: The preliminary media cleanup standards for groundwater will be the MCL. If an MCL does not exist for a compound, then the USEPA RSL for tapwater will be used. In addition, potential cumulative effects will be evaluated.

As a component of a proposed final remedy, site-specific corrective action objectives (CAOs) may also be developed based upon site-specific chemical, media, and future land use considerations. Site-specific CAOs will be developed based on site-specific risk analysis and incorporate media of concern, potential contaminants of concern, potentially exposed populations and pathways, and exposure assumptions. Relevant considerations for the development of site-specific CAOs are provided in the following paragraphs.

Land use near the Facility is characterized by medium to heavy industrial development, and the Facility is zone M1-5 – Manufacturing 1, with a land use of "3110 – Heavy Industry" by the city of Kansas City, Missouri. Future use of the Facility is anticipated to remain industrial. Localized residential developments are located southeast and west of the Facility. Overland access to the Facility by the public is limited by perimeter fencing, gates, and guards throughout most of the Facility. The Facility is marginally accessible from the Blue and Missouri Rivers and Rock Creek.

3.0 CMS ALTERNATIVES

The purpose of Section 3.0 is to identify and evaluate potential remedial alternatives for constituents identified during the SWMU/AOC screening process (see Section 2.2). The initial step in the evaluation process consists of the identification of potentially applicable technologies that may be utilized for the management, containment, treatment, stabilization, and/or disposal of contaminated materials. The technologies selected for preliminary screening represent a range of responses commonly used to address soil and groundwater contamination.

Potential remedial alternatives will be evaluated in detail in the CMS Report for specific SWMUs and AOCs. The criteria utilized in the CMS Report to evaluate the potential remedial alternatives are documented in Section 4.0. The goal of the evaluation process is to choose remedies that are protective of human health and the environment, economically feasible, readily implementable, and provide rapid site restoration. The criteria utilized are consistent to those presented in the RCRA Corrective Action Plan (USEPA, 1994).

3.1 IDENTIFICATION OF POTENTIALLY APPLICABLE TECHNOLOGIES

The first step in developing a recommendation for corrective measures is to identify technologies that may be used to remediate contaminants of concern under the conditions present at the Facility. Tables 3-1 through 3-6 present a range for technologies commonly used in the environmental field to remediate soil and groundwater contamination. The technologies were grouped into six distinct subsets based on their potential application at the Facility. The remedial subsets are:

- "No Action" (Table 3-1);
- Engineering and institutional controls(Table 3-2);
- Source control technologies (Table 3-3);
- Ex-situ soil treatment technologies (Table 3-4);
- In-situ soil treatment technologies (Table 3-5); and
- Groundwater technologies (Table 3-6).

A brief description of each technology is provided in the tables. General comments regarding the potential effectiveness and implementability of each technology are also provided as part of the screening process. Relative unit costs were included; however, these costs will vary significantly from site-to-site and were used as a preliminary indication of the financial resources required to implement each remaining contamination. Environmental covenants also specify how and by whom the limitations can be enforced. Property owners must follow the environmental covenants for as long as the contaminants present on the property pose a potential risk. Environmental covenants are recorded in a property's chain of title and notify prospective buyers of specific limitations about land use and activities due to the environmental condition of the property (MDNR, 2011).

3.1.3 Source Control Technologies

Source control can be used to cover or surround a contaminated area to limit migration of contaminants (see Table 3-3).

3.1.3.1 Caps

Surface capping provides a physical barrier that is effective in minimizing the potential direct exposure of humans and the environment to contaminants. Surface barriers limit infiltration of water into materials that would create contaminated leachate and prevent transportation by erosion, thereby reducing the long-term mobility of contaminants beneath the caps. Capping is generally combined with surface grading and contouring that directs surface water runoff to further minimize infiltration and ponding. Surface caps are already in place at SWMUs 2, 3, and 5.

3.1.3.2 Constructed Barriers

To minimize the migration of groundwater contamination, a vertical barrier can be installed into the subsurface. Examples of constructed barriers include: slurry walls, grout curtains, sheet piling, and synthetic sheeting. The effectiveness of the barrier is dependent upon the barrier's permeability, resistance to deterioration, and imperfections. Barriers are most favorable when groundwater is less than 20 feet bgs and an aquitard is within 40 feet of the ground surface. Sheet piling is in place along the paved portion of the Blue River in the SWMU 33 area, and the Blue River in this area is a paved channel.

3.1.3.3 Surface Contouring

Surface contouring is also considered feasible technology for SWMUs and AOCs at the Facility. Surface contouring has already been performed for SWMUs 2, 3, and 5. At these SWMUs, surface grading and contouring directs surface water runoff to minimize infiltration. Well-maintained features are effective at intercepting, diverting, and routing surface water away from contaminated areas.

3.1.4 Ex-Situ Soil Treatment Technologies

Ex-situ soil treatment involves excavating contaminated soil and/or waste for on-site or off-site disposal (see Table 3-4).

remediation technology that is applied to areas of soil and groundwater contamination. Discussion of DPE is presented in Section 3.1.5.5.

Results from a SVE/DPE pilot study performed at SWMU 33 indicated that SVE and DPE were viable technologies for remediation of VOCs in soil at SWMU 33.

3.1.5.2 Solidification/Stabilization

Solidification/stabilization reduces the mobility of hazardous substances and contaminants in the environment through both physical and chemical means. Leachability testing is typically performed to measure the immobilization of contaminants. Soil is treated in-place. Solidification/stabilization is generally effective for the treatment of metals and SVOCs. It is generally not recommended for sludge or extremely oily soils.

3.1.5.3 Chemical Oxidation/Reduction

Discussion of chemical oxidation-reduction is presented in Section 3.1.6.4.

3.1.6 Groundwater Technologies

Groundwater treatment technologies include passive and active techniques and can be conducted in-situ or ex-situ (see Table 3-6).

3.1.6.1 Long-Term Monitoring

A long-term groundwater monitoring and analysis program may be used to identify changes in groundwater flow patterns, contaminant levels, and to track contaminant plume migration. In the absence of remedial action, monitoring will not reduce the contaminant migration, nor prevent contaminant levels from increasing. However, monitoring provides an effective method to assess the potential impact of contaminants on identified receptors. Long-term monitoring is a component of monitored natural attenuation to confirm natural subsurface biological, chemical, and physical processes such as dispersion, volatilization, dilution, adsorption, and biodegradation are occurring consistent with cleanup objectives.

3.1.6.2 Monitored Natural Attenuation with Source Control

Monitored natural attenuation relies on natural biological, chemical, and physical processes to reduce contaminant levels. Natural attenuation includes both nondestructive mechanisms (dispersion, volatilization, dilution, and adsorption) as well as destructive mechanisms, such as biodegradation. Consideration of this option usually requires modeling and evaluation of contaminant degradation rates and pathways and predicting contaminant concentration at downgradient receptor points, especially when the plume is still expanding/migrating. In addition, long term monitoring must be conducted throughout costly than other oxidants. However, potential regulatory and water quality concerns exist due to increased manganese concentrations in the subsurface when using permanganate; likewise, increased sodium sulfate concentrations in the subsurface is a potential concern when using persulfate. In addition, groundwater can become stained purple from unreacted permanganate. Fenton's reagent, permanganate, and persulfate have the potential to produce particulates during the reaction that can reduce permeability in fine-grained materials. Zero-valent iron also has the potential to reduce aquifer permeability when injected. Emulsified zero-valent iron compounds have demonstrated effective remediation of dense non-aqueous phase liquids.

3.1.6.5 Air Sparging

Air sparging is an in-situ technology in which air is injected through a contaminated aquifer. Injected air traverses horizontally and vertically in channels through the soil column, creating an underground stripper that removes contaminants. The injected air helps to flush (bubble) the contaminants up into the unsaturated zone where a vapor extraction system removes the generated vapor phase contamination. This technology is designed to operate at high flow rates to maintain increased contact between groundwater and soil and to strip more groundwater by sparging. Oxygen added to contaminated groundwater and vadose zone soils can enhance biodegradation of contaminants below and above the water table. The target contaminant groups for air sparging are VOCs and fuels.

3.1.6.6 Dual Phase Extraction

Fluid/vapor extraction (also referred to as DPE) can be used to remediate VOCs in soil and groundwater. A high vacuum system is applied to remove liquid and gas from low permeability or heterogeneous formations. The vacuum extraction well is screened in the zone of contaminated soils and groundwater. The system lowers the water table around the well, exposing more of the formation. Contaminants in the newly exposed vadose zone are then accessible to vapor extraction. Because of the turbulence created during extraction, most of the contaminants in the water are stripped away, and little additional treatment is needed. It is more effective than SVE for heterogeneous clays and fine sands.

3.2 REMEDIAL ALTERNATIVE EVALUATION IN CMS

This section identifies the remedial alternatives that will be evaluated for each SWMU/AOC.

3.2.1 Facility-Wide Alternatives

The following engineering and institutional controls will be evaluated on a Facility-wide basis as part of the CMS:

- LTM
- Monitored natural attenuation with source control
- Air sparging
- DPE
- Chemical oxidation/reduction
- Enhanced bioremediation

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4.0 EVALUATION OF CORRECTIVE MEASURES

4.1 TECHNIQUE FOR EVALUATION OF CORRECTIVE MEASURE ALTERNATIVES

The purpose of a CMS is to identify and evaluate potential remedial alternatives for facilities requiring corrective action. Selection of appropriate corrective measure alternatives is based on the principle that the selected alternative is protective of human health and the environment. USEPA currently has the following expectations for corrective measures.

- Corrective measures should address the principal contamination threats posed by a site whenever practicable and cost-effective.
- Engineering controls, such as containment, for contaminated media are acceptable as corrective measures so long as minimal long-term threat to human health and the environment and remedial impracticability, are demonstrated.
- Active remediation, engineering controls, and institutional controls can be utilized concurrently at a site so long as human health and the environment are protected.
- Institutional controls, while useful in combination with engineering controls and active remediation, should not generally be used as the sole corrective measure for a site.
- Innovative remedial technologies should be favored over conventional remedial technologies as corrective measures when advantages of superior treatment or implementability, less adverse impact, or lower overall costs can be realized.
- Groundwater should be restored to its maximum beneficial usage wherever practicable within a reasonable, site-specific timeframe. Where groundwater restoration is not practicable, prevention or minimization of further groundwater plume migration; prevention of groundwater exposure to humans or the environment; and additional risk reduction evaluation, is necessary. Surface and/or subsurface sources of groundwater contamination should be controlled or eliminated.
- Corrective measures should be implemented on contaminated soils as necessary to prevent or limit direct exposure to human or environmental receptors and prevent transfer of unacceptable levels of contamination to other media via leaching, runoff, or airborne emissions.

- Sensitivity of expected performance to reasonable variation of key uncertainties
- Differences between the alternatives (qualitative or quantitative)
- A description of potential advantages of an alternative in cost or performance, and the degree of certainty of these associated with each

4.2.1 Protection of Human Health and the Environment

Corrective action remedies must be protective of human health and the environment. Each alternative is evaluated on its potential to prevent exposure risk to humans and the environment during and after remedial action is initiated. Technologies posing the least short- and long-term risk to human health and the environment are the most desirable for remedial activities. Risks associated with source control and management of wastes generated during remedial actions are also considered in the evaluation. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	No risk to human health and the environment.
	Good	More protective than risk criteria.
	Adequate	Meets risk criteria.
UNFEASIBLE	Exceeds human health and environmental risk criteria.	

4.2.2 Attainment of Media Cleanup Standards

Media cleanup standards are the contaminant concentrations and site conditions that do not pose unacceptable risks to human health and the environment. Remedial alternatives are evaluated based on their ability to meet media cleanup standards at the point of compliance in an expeditious timeframe. Local geologic and waste characteristics are evaluated to determine if corrective action alternatives are capable of attaining media cleanup standards. When possible, each potential alternative's effectiveness is evaluated by comparing the estimated effectiveness of the various alternatives with case histories conducted in similar environments. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Remediation achieves background concentrations.
	Good	Cleanup results in concentrations less than media cleanup standards.
	Adequate	Meets media cleanup standards.
UNFEASIBLE	Unable to meet media cleanup standards.	

important factor in evaluating long-term reliability. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Eliminates threat to human health. Remedial actions are permanent and require to no long-term maintenance.
	Good	Minimizes further contaminant migration and threat to human health. Major technologies are permanent, and other components continue to perform unattended with minimal maintenance.
	Adequate	Adequately protects human health by reducing contaminant releases. Overall remedial option may require regular maintenance.
	Poor	Provides for limited protection of human health by reducing the potential for exposure to contaminants. The long-term effectiveness is dependent upon maintenance.
UNFEASIBLE	Provides no protection to human health or the environment. After implementation, human or ecological receptors are exposed to elevated concentrations of harmful compounds. Remedial option may require frequent and extensive maintenance. Useful life of remediation equipment and processes may be less than restoration timeframe.	

4.2.6 Reduction of Toxicity, Mobility, or Volume

Remedial alternatives that minimize risk by reducing the toxicity, mobility, or volume of waste residuals are expected to provide the greatest long-term protection of human health and the environment. Permanent reduction of the waste's toxicity, mobility, or volume is the most desirable method of minimizing long term risks. This criterion is evaluated by comparing initial site conditions to expected post-corrective measure conditions. Recommended alternatives are chosen based on their expected effectiveness in reducing the toxicity, mobility, or volume of wastes found at each SWMU/AOC. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Elimination of toxicity, mobility, or volume of hazardous constituents with no generation of hazardous residuals.
	Adequate	Acceptable reduction of toxicity, mobility, or volume of primary hazardous constituents with manageable residuals.
UNFEASIBLE	No reduction in toxicity, volume, or mobility of hazardous constituents is provided. Exposure risk is not significantly reduced.	

implementation, the ease of undertaking additional remedial action in the future, and the ability to monitor the effectiveness of the proposed alternative. Administrative implementability refers to administrative requirements that may be requested by various regulatory agencies. An alternative to be initiated expeditiously with minimal effort is most desirable. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	No implementability concerns.
	Good	May be implemented with minor technical concerns.
	Adequate	Implementation is possible, but administrative, technical, and regulatory issues prevent rapid implementation of the alternative.
	Poor	Technical, administrative, and/or regulatory issues, make implementation of remedial alternative difficult.
UNFEASIBLE	Technical, administrative, or availability issues prohibit implementation.	

4.2.9 Economic Feasibility

Economic feasibility may be used to choose between several alternatives offering similar protection of human health and the environment. Capital and annual operation and maintenance costs are used in the evaluation of alternatives. The present worth of an alternative is the primary dollar figure used for comparative cost evaluation. The following table gives general guidelines for assessing alternatives from ideal to unfeasible:

FEASIBLE	Ideal	Limited financial obligation.
	Good	Relatively less costly than other alternatives.
	Adequate	Similar costs to other alternatives.
	Poor	Significantly more costly than other alternatives.
UNFEASIBLE	Cost prohibits implementation.	

* * * * *

5.0 PILOT, LABORATORY, AND/OR BENCH SCALE STUDIES

Remedial technologies may require additional testing to determine appropriateness for application at a specific SWMU or AOC. Bench scale studies, laboratory tests, and/or pilot studies can be conducted to determine implementabilty and effectiveness or remedial technologies based on site-specific factors. If it is determined that a pilot, laboratory, and/or bench scale study(s) is warranted, a detailed description of the proposed study(s) and a schedule for implementation will be provided to USPEA and MDNR. For example, the additional studies may be warranted if the following remedial alternatives are selected:

- Treatment of soil using solidification/stabilization (in-situ or ex-situ) techniques will require bench testing to identify binding reagents which will improve the chemical and physical characteristics of the soils. A pilot study (field test) would also be conducted to verify if the reagent/soil mixture ratios identified in the bench test achieve adequate stabilization/solidification.

- Chemical oxidation technology requires bench testing to determine natural oxidant demand and calculate oxidant dosage.

- SVE, air sparging, and DPE require pilot testing to confirm feasibility and effectiveness under site-specific conditions. A SVE/DPE pilot test was performed in 2011 at SWMU 33 to evaluate the technologies for remediation of impacted soil the site. The results of the pilot test indicated that SVE and DPE were viable technologies for remediation of the soil source at the site. Further details regarding the SVE/DPE pilot test at SWMU 33 are provided in the *Supplemental Investigation Addendum Report and Pilot Study Work Plan* (BMcD, 2010a) and the *SVE/DPE Pilot Test Evaluation for the SWMU 33 Nail Mill Degreasing Area, AK Steel, Kansas City, Missouri* (BMcD, 2011).

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6.0 CMS REPORT OUTLINE

A CMS Report will be prepared that presents an update to current conditions, additional SWMU/AOC constituent evaluations (i.e., 95 UCL calculations, SWMU/AOC-specific risk assessment, etc.), media cleanup standards, and the corrective measures evaluation. A proposed outline for the CMS Report follows:

1.0 INTRODUCTION
- 1.1. Purpose and Scope
- 1.2. Background
  - 1.2.1. Facility Location
  - 1.2.2. Facility History
  - 1.2.3. Tasks Completed to Date
- 1.3. Environmental Setting

2.0 Description of Current Conditions and SWMU/AOC Screening
- 2.1. SWMU 2 – Old Blue River "W" Landfill
- 2.2. SWMU 3 – South of Bar Fab Landfill
- 2.3. SWMU 4 – 1987 Waste Pile
- 2.4. SWMU 5 – Plant Rubble Landfill
- 2.5. SWMU 6 – RCRA Permitted Baghouse Dust Tanks
- 2.6. SWMU 7 – No. 1 Melt Shop Baghouse Dust Tanks
- 2.7. SWMU 12 – AMOCO Landfarm
- 2.8. SWMU 13 – Pickle Liquor Tanks
- 2.9. SWMU 17 – Wire Mill Rinsewater Neutralization Tank
- 2.10. SWMU 24 – Waste Hydraulic Lubricating Oil Storage Tanks
- 2.11. SWMU 33 – Nail Mill Degreasing Area
- 2.12. AOC 1 – Abandoned Fuel Oil Storage Tank
- 2.13. AOC 4 – Boiler Furnace Area
- 2.14. AOC 8 – "Owl Gun Club" Shooting Park

3.0 ESTABLISHMENT OF CORRECTIVE ACTION OBJECTIVES
- 3.1. Target Media Cleanup Standards (Numerical Standards)
- 3.2. Non-Numerical Cleanup Standards
- 3.3. Compliance Points

4.0 REMEDIAL ALTERNATIVE EVALUATION PROCESS
- 4.1. Identification and Screening of Potentially Applicable Remedial Alternatives
- 4.2. Potential Corrective Action Alternatives
- 4.3. Screening Criteria for Potential Corrective Measures Alternatives
  - 4.3.1. Protection of Human Health and the Environment
  - 4.3.2. Attainment of Media Cleanup Standards
  - 4.3.3. Control Source of Release
  - 4.3.4. Compliance with Local, State, and Federal Regulations
  - 4.3.5. Long-Term Reliability on Effectiveness
  - 4.3.6. Reduction of Toxicity, Mobility, or Volume
  - 4.3.7. Short-Term Effectiveness

7.0 PROJECT MANAGEMENT

7.1 ORGANIZATION

Planning, evaluation, and reporting for the CMS will be conducted by BMcD and coordinated with AK Steel, USEPA, and MDNR. Key project personnel are outlined in this section The project organization for the CMS is illustrated in Figure 7-1.

7.1.1 AK Steel

AK Steel will be responsible for providing day-to-day project coordination with the MDNR, USEPA, and BMcD. Mr. Cory Levengood will serve as the Primary Point of Contact. Contact information for Mr. Levengood is as follows:

Name	Primary Point of Contact
AK Asset Management Company 5050 Section Avenue Cincinnati, OH 65212	Mr. Cory Levengood Phone: (513) 772-2840 or (513) 425-2711 Email: cory.levengood@aksteel.com

7.1.2 USEPA

USEPA is providing regulatory oversight of AK Steel's RCRA corrective action activities under Part II of the Permit. USEPA has overall responsibility for project coordination and review responsibilities for the CMS. Mr. Bruce Morrison will serve as the USEPA Region 7 Project Manager. Contact information for the USEPA Project Manager is as follows:

Name	Primary Point of Contact
USEPA, Region 7 901 North 5th Street Kansas City, KS 66101-2907	Mr. Bruce Morrison Phone: (913) 551-7755 Email: morrison.bruce@epa.gov

7.1.3 MDNR

MDNR is providing regulatory oversight of AK Steel's post closure activities at the closed RCRA Landfill. In addition, MDNR is providing review and comments on project documents related to corrective action. MDNR will review project documents and submit comments to USEPA. Ms. Christine Kump-Mitchell will serve as the MDNR Project Manager. Contact information for the MDNR Project Manager is as follows:

conflicts, errors, and omissions, and verifying technical accuracy. Contact information for the BMcD Project Manager is as follows:

Name	Primary Point of Contact
Burns & McDonnell	Ms. Sharon Shelton
9400 Ward Parkway	Phone: (816) 822-3168
Kansas City, MO 64114	E-mail: sshelton@burnsmcd.com

7.1.4.3 Engineering Manager

The BMcD Engineering Manager is responsible for supervising and directing all engineering design and technical remedial evaluations for the CMS. Mr. John Hesemann, P.E. will serve as the engineering manager for BMcD. The Engineering Manager will provide guidance, direction, and support to the design team and will be responsible for all engineering deliverables for the project. Contact information for the Engineering Manager is as follows:

Name	Primary Point of Contact
Burns & McDonnell	Mr. John Hesemann
425 South Woods Mill Road, Suite 300	Phone: (314) 682-1560
Chesterfield, MO 63017	E-mail: jhesemann@burnsmcd.com

7.1.4.4 Health and Safety Manager

The Health and Safety Manager (HSM) is a Certified Industrial Hygienist (CIH) who will provide professional support by reviewing all health and safety programs as they apply to this project. The HSM will approve the Health and Safety Plan (HASP) and all modifications to the plan as they affect the health and safety of field personnel. The HSM is responsible for providing professional health and safety support and oversight management to the Site Health and Safety Supervisor (SHSS). The HSM will review and provide support in all concerns regarding the health and safety of field personnel assigned to this project. Periodic field audits of the project work site may be conducted by the HSM to evaluate the adequacy of the program and implement any necessary changes. Contact information for the BMcD HSM is as follows:

Name	Primary Point of Contact
Burns & McDonnell	Mr. Eric Wenger, CIH
9400 Ward Parkway	Phone: (816) 822-3894
Kansas City, MO 64114	E-mail: ewenger@burnsmcd.com

7.1.4.5 Project Team

The BMcD project team will be experienced in investigation and remediation and will have shown technical proficiency in their respective professional areas of expertise (i.e., chemistry, geology, submitted to USEPA 240 days following CMS Work Plan approval. For certain SWMU/AOCs, additional activities (i.e., data collection, pilot, laboratory, and/or bench scale studies) may be needed to adequately evaluate a SWMU/AOC or remedial option. If contingent activities are identified during development of the CMS Report, USEPA and MDNR will be made aware of the additional data needs and a proposal for contingent activities will be provided. If appropriate, a meeting will be held with USEPA and MDNR technical staff to discuss and agree upon the contingent CMS activities and a separate reporting schedule for the additional evaluation.

* * * * *

8.0 REFERENCES

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TABLES

Table 2-1
Soil Screening Levels for CMS
SWMUs and AOCs West of I-435
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Parameter	Units	CMS Screening Level		
INORGANICS				
Arsenic, Total	mg/kg	24		BVBG
Barium, Total	mg/kg	15,000		Res RSL
Cadmium, Total	mg/kg	70		Res RSL
Chromium, Total	mg/kg	120,000	a	Res RSL
Chromium, Trivalent	mg/kg	120,000		Res RSL
Lead, Total	mg/kg	1,531		Site PRG
Mercury, Total	mg/kg	23	b	Res RSL
Mercury, Elemental	mg/kg	10	c	Res RSL
Selenium, Total	mg/kg	390		Res RSL
Silver, Total	mg/kg	390		Res RSL
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	mg/kg	8,700		Res RSL
1,1,2-Trichloroethane	mg/kg	1.1		Res RSL
1,1-Dichloroethane	mg/kg	3.3		Res RSL
1,1-Dichloroethene	mg/kg	240		Res RSL
1,2-Dichloroethane	mg/kg	0.43		Res RSL
1,2,4-Trichlorobenzene	mg/kg	22		Res RSL
2-Butanone	mg/kg	28,000		Res RSL
2-Hexanone	mg/kg	210		Res RSL
4-Methyl-2-pentanone	mg/kg	5,300		Res RSL
Acetone	mg/kg	61,000		Res RSL
Benzene	mg/kg	1.1		Res RSL
Carbon disulfide	mg/kg	820		Res RSL
Chlorobenzene	mg/kg	290		Res RSL
Chloroform	mg/kg	0.29		Res RSL
cis-1,2-Dichloroethene	mg/kg	160		Res RSL
Ethylbenzene	mg/kg	5.4		Res RSL
Methylene chloride	mg/kg	56		Res RSL
Styrene	mg/kg	6,300		Res RSL
Tetrachloroethene	mg/kg	22		Res RSL
Toluene	mg/kg	5,000		Res RSL
trans-1,2-Dichloroethene	mg/kg	150		Res RSL
Trichloroethene	mg/kg	0.91		Res RSL
Vinyl chloride	mg/kg	0.06		Res RSL
Xylene, m,p-	mg/kg	590		Res RSL
Xylene, o-	mg/kg	690		Res RSL
Xylenes, Total	mg/kg	630		Res RSL
SEMIVOLATILE ORGANIC COMPOUNDS				
1-Methylnaphthalene	mg/kg	16		Res RSL
2,4-Dimethylphenol	mg/kg	1,200		Res RSL
2-Methylnaphthalene	mg/kg	230		Res RSL
4-Methylphenol	mg/kg	6,100		Res RSL
Acenaphthene	mg/kg	3,400		Res RSL
Acenaphthylene	mg/kg		--	
Anthracene	mg/kg	17,000		Res RSL
Benzo(a)anthracene	mg/kg	0.15		Res RSL
Benzo(a)pyrene	mg/kg	0.386		BVBG
Benzo(b)fluoranthene	mg/kg	0.364		BVBG
Benzo(g,h,i)perylene	mg/kg		--	
Benzo(k)fluoranthene	mg/kg	1.5		Res RSL

Table 2-2
Soil Screening Levels for CMS SWMUs and AOCs East of I-435
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Parameter	Units	CMS Screening Level		
INORGANICS				
Cadmium, Total	mg/kg	3.94		BVBG
Chromium, Total	mg/kg	38.8		BVBG
Chromium, Trivalent	mg/kg	38.8	a	BVBG
Lead, Total	mg/kg	1,531		Site PRG
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	mg/kg	29.8		R5 Eco
2-Butanone	mg/kg	89.6		R5 Eco
Acetone	mg/kg	2.5		R5 Eco
Benzene	mg/kg	0.255		R5 Eco
Carbon disulfide	mg/kg	0.0941		R5 Eco
Chlorobenzene	mg/kg	13.1		R5 Eco
Ethylbenzene	mg/kg	5.16		R5 Eco
Methylene chloride	mg/kg	4.05		R5 Eco
Styrene	mg/kg	4.69		R5 Eco
Tetrachloroethene	mg/kg	9.92		R5 Eco
Toluene	mg/kg	5.45		R5 Eco
Xylene, m,p-	mg/kg	590	b	Res RSL
Xylene, o-	mg/kg	690		Res RSL
Xylenes, Total	mg/kg	10		R5 Eco
SEMIVOLATILE ORGANIC COMPOUNDS				
2-Methylnaphthalene	mg/kg	3.24		R5 Eco
Anthracene	mg/kg	1480		R5 Eco
Benzo(a)anthracene	mg/kg	0.15		Res RSL
Benzo(a)pyrene	mg/kg	0.386		BVBG
Benzo(b)fluoranthene	mg/kg	0.364		BVBG
Benzo(g,h,i)perylene	mg/kg	119		R5 Eco
Benzo(k)fluoranthene	mg/kg	1.5		Res RSL
Chrysene	mg/kg	4.73		R5 Eco
Dibenzo(a,h)anthracene	mg/kg	0.178		BVBG
Dibenzofuran	mg/kg	78		Res RSL
Fluoranthene	mg/kg	122		R5 Eco
Indeno(1,2,3-cd)pyrene	mg/kg	0.323		BVBG
Naphthalene	mg/kg	0.0994		R5 Eco
Phenanthrene	mg/kg	45.7		R5 Eco
Pyrene	mg/kg	78.5		R5 Eco
TOTAL PETROLEUM HYDROCARBONS				
TPH (extractable)	mg/kg		--	
TPH (volatile)	mg/kg		--	

Screening levels are presented for constituents that have been detected in soil samples collected from SWMUs and AOCs east of I-435 (i.e., SWMU 4, SWMU 12, and AOC 8). Screening levels are not presented for constituents that were analyzed but not detected.

mg/kg - millgrams per kilogram

a - BVBG value for total chromium was applied to trivalent chromium.
b - m-Xylene and p-Xylene could not be differentiated by lab. The lower screening level for m-xylene was used.

BVBG - Blue Valley Industrial Corridor Soils Background Study Report, Brownfields Showcase Project (USACE, 2003)

Res RSL - Residential Soil Regional Screening Level Summary Table (USEPA, May 2012)

R5 Eco - USEPA Region 5, RCRA, Ecological Screening Levels (USEPA, 2003)

Site-Specific PRG - Site-specific preliminary remediation goal for lead (USEPA, 2010)

Table 2-3
Groundwater Screening Levels for CMS
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Parameter	Units	CMS Screening Level		
INORGANICS				
Arsenic	mg/L	0.01		MCL
Barium	mg/L	2		MCL
Cadmium	mg/L	0.005		MCL
Chromium, Trivalent	mg/L	16		RSL
Chromium, Total	mg/L	0.1		MCL
Lead	mg/L	0.015		MCL
Mercury	mg/L	0.002		MCL
Selenium	mg/L	0.05		MCL
Silver	mg/L	0.071		RSL
VOLATILE ORGANIC COMPOUNDS				
1,1,1-Trichloroethane	µg/L	200		MCL
1,1,2-Trichloroethane	µg/L	5		MCL
1,1-Dichloroethane	µg/L	2.4		RSL
1,1-Dichloroethene	µg/L	7		MCL
1,2-Dichloroethane	µg/L	5		MCL
1,2-Dichloropropane	µg/L	5		MCL
4-Methyl-2-pentanone	µg/L	1,000		RSL
Acetone	µg/L	12,000		RSL
Benzene	µg/L	5		MCL
Carbon disulfide	µg/L	720		RSL
Carbon tetrachloride	µg/L	5		MCL
Chloroform	µg/L	80	a	MCL
cis-1,2-Dichloroethene	µg/L	70		MCL
Ethylbenzene	µg/L	700		MCL
Methylene chloride	µg/L	5		MCL
Tetrachloroethene	µg/L	5		MCL
Toluene	µg/L	1,000		MCL
trans-1,2-Dichloroethene	µg/L	100		MCL
Trichloroethene	µg/L	5		MCL
Vinyl acetate	µg/L	410		RSL
Vinyl chloride	µg/L	2		MCL
Xylene, m,p-	µg/L	190		RSL
Xylene, o-	µg/L	190		RSL
Xylenes, Total	µg/L	10,000		MCL
SEMIVOLATILE ORGANIC COMPOUNDS				
2,4-Dimethylphenol	µg/L	270		RSL
2-Methylphenol	µg/L	720		RSL
4-Chloroaniline	µg/L	0.32		RSL
4-Methylphenol	µg/L	1,400		RSL
Benzo(a)pyrene	µg/L	0.2		MCL
Benzo(b)fluoranthene	µg/L	0.029		RSL
Benzo(k)fluoranthene	µg/L	0.29		RSL
Bis(2-ethylhexyl)phthalate	µg/L	6		MCL
Chrysene	µg/L	2.9		RSL
Fluoranthene	µg/L	630		RSL
Isophorone	µg/L	67		RSL
Naphthalene	µg/L	0.14		RSL
Phenanthrene	µg/L		--	
Phenol	µg/L	4,500		RSL
Pyrene	µg/L	87		RSL
TOTAL PETROLEUM HYDROCARBONS				
TPH (extractable)	mg/L		--	
TPH (volatile)	mg/L		--	

Table 3-1
"No Action"
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
No Action	Site is left "as is" with no remedial actions performed.	Dependent on site conditions.	Implementation is easy.	None	Used as a baseline comparison to other alternatives.

Table 3-2
Engineering and Institutional Controls
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Access Control	Prevents individuals from inadvertently coming in contact with areas of contamination. May include surveillance systems, artificial or natural barriers, entry control and signs.	Dependent on maintenance of boundaries and surveillance systems and proper training of security force.	Currently implemented Facility-wide.	Access control is currently being implemented and financed under existing operations.	
Institutional Controls / Use Restrictions	Missouri Environmental Covenants Act (MoECA) document	Dependent on enforcement vehicle.	Administrative effort is required to draft restriction and file with MDNR.	Recording fee is low.	Site is currently zoned heavy industrial. Location in 100-year floodplain restricts construction under existing City of Kansas City, Missouri ordinances. The aquifer underlying the Facility is not currently utilized as a source of water.

Table 3-3
Source Control Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Cap	Contaminants are covered. Cover limits infiltration, promotes effective drainage, and prevents direct-contact of contaminants with potential receptors.	Contingent on regular maintenance.	Relatively easy to implement. Construction is performed using common equipment and materials. Surface caps are currently in place at SWMUs 2, 3, and 5.	Low to Moderate	Requires regular inspection and maintenance.
Constructed Barriers	Vertical barrier installed into the subsurface to minimize the migration of groundwater contamination. Examples are slurry walls, grout curtains, sheet piling, and synthetic sheeting.	Dependent on permeability, resistance to deterioration, and imperfections of barrier. Unfavorable for highly reactive contaminants and in expansive soils.	Most favorable when groundwater <20 feet and aquitard within 40 feet of ground surface. Sheet piling is currently in place along the paved portion of the Blue River in the SWMUs 17 and 33 area.	Moderate to High	
Surface Contouring	Surface grading/contouring directs surface water runoff to minimize infiltration and ponding. Construction of drainage swales, berms, and/or ditches are examples.	Well maintained features are effective at intercepting, diverting, and routing surface water away from contaminated areas.	Often used in conjunction with caps. Relatively easy to implement. Construction is performed using common equipment and materials. Surface contouring has already been performed for SWMUs 2, 3, and 5.	Low to Moderate	Requires regular inspection and maintenance.

Table 3-4
Ex-Situ Soil Treatment Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Solidification/ Stabilization	Solidification/stabilization reduces the mobility of hazardous substances and contaminants in the environment through both physical and chemical means. Contaminants are physically bound or enclosed within a solidified mass (solidification), and/or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Generally effective for metals and some organics. Soil may require pretreatment for VOCs. Generally not recommended for sludges or extremely oily soils.	Technology is offered by numerous vendors. Bench or pilot tests are needed.	Moderate to High. Capital intensive.	Ex-situ treatment solid residuals are commonly disposed off-site.
Off-Site Landfilling	Contaminated materials are removed and transported to a permitted treatment and disposal facility.	Effectiveness is dependent on long-term management of disposed wastes.	Approval from landfill and regulatory agency is required.	Moderate to High	Concern regarding long-term liabilities.

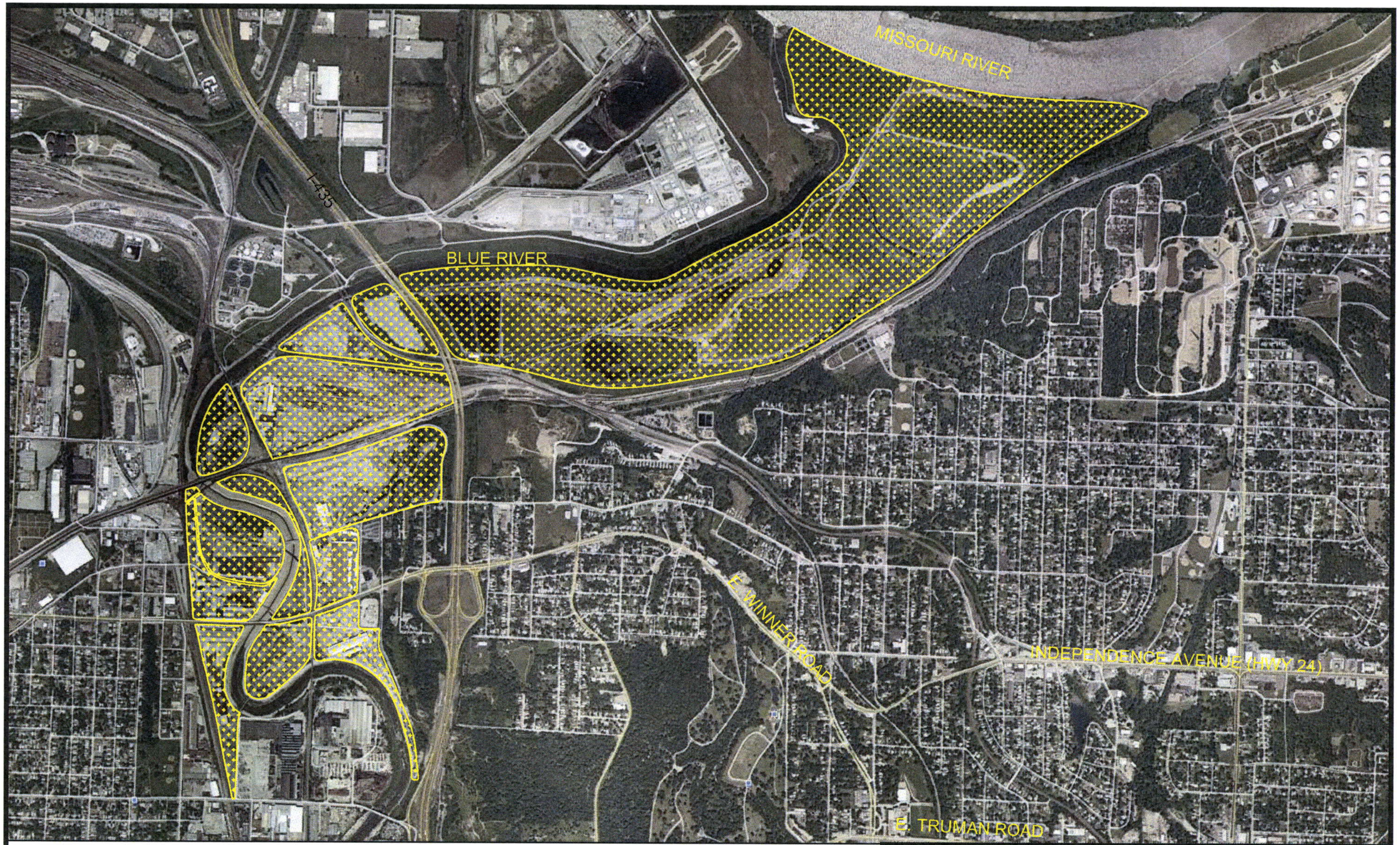
Table 3-5
In-Situ Soil Treatment Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Soil Vapor Extraction	Vacuum is applied through extraction wells to create a pressure/concentration gradient that induces gas-phase volatiles to be removed from soil through extraction wells. Also known as in-situ soil venting, in-situ volatilization, enhanced volatilization, or soil vacuum extraction.	Dependent on Henry's Law Constant of contaminant, moisture content, and air permeability of soil. Effective on VOCs and some fuels. Low permeability surface cap will enhance performance.	Field pilot study required. May require permitting. Successful pilot test conducted at SWMU 33.	Low to Moderate. Capital and O&M intensive.	Not effective for treatment of inorganics. Soil with a high percentage of fines and degree of saturation will require higher vacuum (higher cost).
Solidification/ Stabilization	Solidification/stabilization reduces the mobility of hazardous substances and contaminants in the environment through both physical and chemical means. Contaminants are physically bound or enclosed within a solidified mass (solidification), and/or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Generally effective for metals and some organics. Soil may require pretreatment for VOCs. Generally not recommended for sludges or extremely oily soils.	Technology is offered by numerous vendors. Bench or pilot tests are needed.	Moderate to High. Capital intensive.	In-situ treatment can be limited by depth of contaminants and solidified materials may hinder future site use.
Chemical Oxidation / Reduction	Oxidizing or Reducing compounds are introduced into the subsurface, usually by chemical injection. In chlorinated solvents, carbon-chlorine bonds are attacked thereby causing degradation.	Dependent on subsurface geology (reduced effectiveness in low permeability materials without fracturing, etc.). May require mulitple treatment applications. Target compounds are VOCs.	Pilot studies are needed. May require permitting. Equipment and materials are readily available.	Moderate	Heterogeneity and low permeability may cause some soil zones to be relatively unaffected.

Table 3-6
Groundwater Treatment Technologies
Corrective Measures Study Work Plan
AK Steel Kansas City Facility

Technology	Description	Effectiveness	Implementability	Relative Cost	Comments
Long-Term Monitoring	Groundwater monitoring and analysis program used to identify changes in groudnwater flow patterns, contamiant levels, and contaminant plume migration.	Assesses the potential impact of contaminants on identified receptors. Does not reduce contaminnat level or control contaminant migration.	Equipment and materials are readily available.	Low to Moderate	Can be used in combination with other treatment technologies.
Monitored Natural Attenuation with Source Control	Natural biological, chemical, and physical processes such as dispersion, volatilization, dilution, adsorption, and biodegradation reduce contaminant concentrations to acceptable levels.	Dependent on site conditions. Target contaminants are VOCs, SVOCs, and fuel hydrocarbons.	Requires modeling / evaluation of contaminant degradation rates, pathways, concentration(s) at receptor points.	Low to Moderate	Continuous monitoring until cleanup levels achieved.
Enhanced Bioremediation	Microorganisms or nutrients are introduced into the subsurface to increase degradation of organics by indigenous microbes, either aerobically or anaerobically.	Dependent on subsurface aquifer chemistry and geology (reduced effectiveness in low permeability materials without fracturing, etc.). May require mulitple treatment applications. Target contaminants are VOCs and fuel hydrocarbons.	Pilot studies are needed. May require permitting. Equipment and materials are readily available.	Moderate	Heterogeneity and low permeability may cause some soil zones to be relatively unaffected.
Chemical Oxidation / Reduction	Oxidizing or Reducing compounds are introduced into the subsurface, usually by chemical injection. In chlorinated solvents, carbon-chlorine bonds are attacked thereby causing degradation.	Dependent on subsurface chemistry and geology (reduced effectiveness in low permeability materials without fracturing, etc.). May require mulitple treatment applications. Targert compounds are VOCs.	Pilot studies are needed. May require permitting. Equipment and materials are readily available.	Moderate	Heterogeneity and low permeability may cause some soil zones to be relatively unaffected.
Air Sparging	Air is injected horizontally and vertically through a contaminated aquifer to remove contaminants by volatilization. A vapor extraction system is used to collect vapors from the vadose zone for treatment.	Dependent on subsurface geology (reduced effectiveness in low permeability materials). May enhance aerobic bioremediation of contaminants. Target contaminants are VOCs and fuels.	Pilot studies are needed. May require permitting. Unfavorable in low permeability aquifers.	Moderate	Soil heterogeneity may cause some soil zones to be relatively unaffected. Has potential to spread contamination.

FIGURES



LEGEND:

AK STEEL PROPERTY BOUNDARY

NORTH

0 2000' 4000'

SCALE IN FEET

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Figure 1-1

FACILITY LOCATION MAP
AK STEEL
KANSAS CITY, MISSOURI

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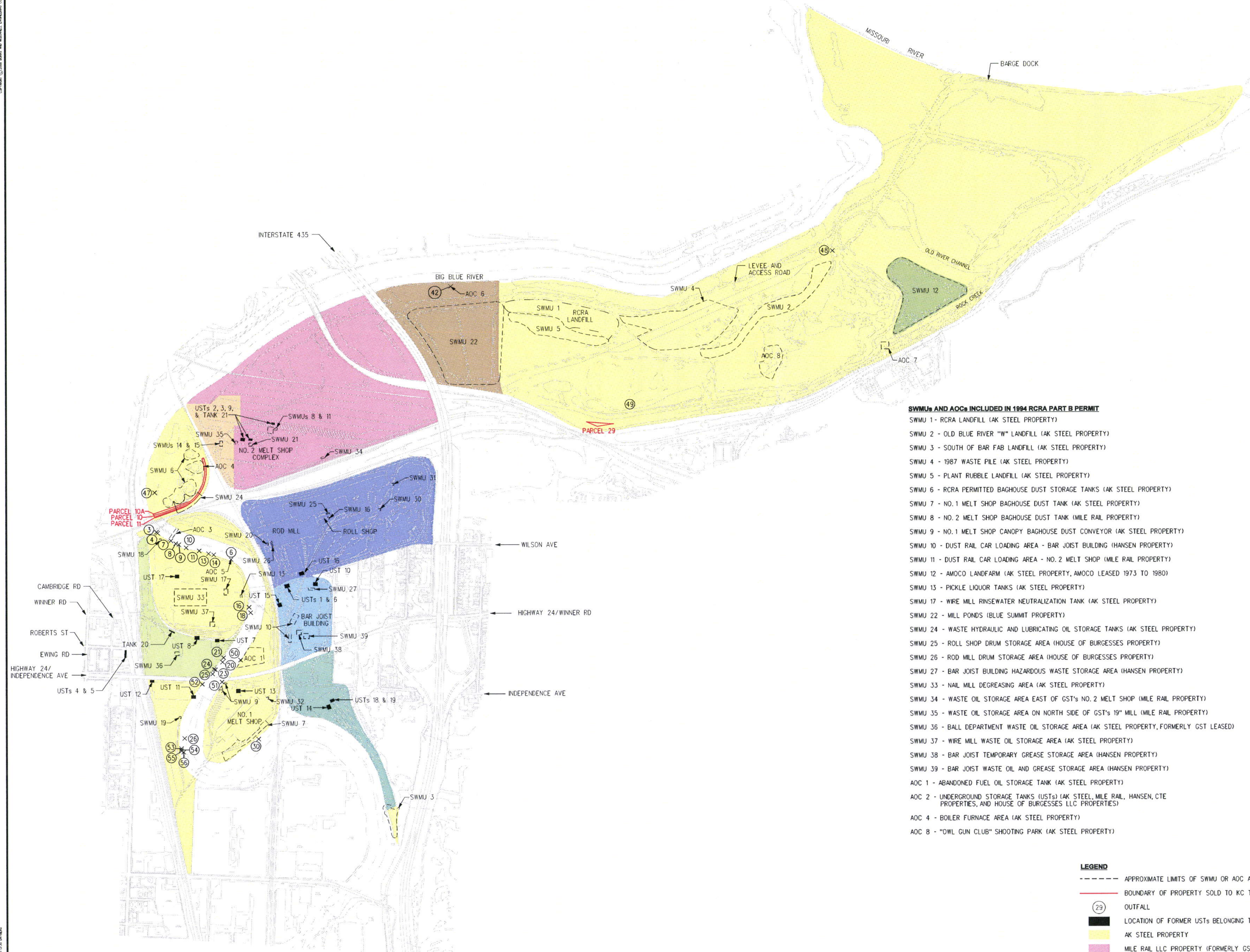


SWMUs AND AOCs INCLUDED IN 1994 RCRA PART B PERMIT

SWMU 1 - RCRA LANDFILL (AK STEEL PROPERTY)
SWMU 2 - OLD BLUE RIVER "W" LANDFILL (AK STEEL PROPERTY)
SWMU 3 - SOUTH OF BAR FAB LANDFILL (AK STEEL PROPERTY)
SWMU 4 - 1987 WASTE PILE (AK STEEL PROPERTY)
SWMU 5 - PLANT RUBBLE LANDFILL (AK STEEL PROPERTY)
SWMU 6 - RCRA PERMITTED BAGHOUSE DUST STORAGE TANKS (AK STEEL PROPERTY)
SWMU 7 - NO. 1 MELT SHOP BAGHOUSE DUST TANK (AK STEEL PROPERTY)
SWMU 8 - NO. 2 MELT SHOP BAGHOUSE DUST TANK (MILE RAIL PROPERTY)
SWMU 9 - NO. 1 MELT SHOP CANOPY BAGHOUSE DUST CONVEYOR (AK STEEL PROPERTY)
SWMU 10 - DUST RAIL CAR LOADING AREA - BAR JOIST BUILDING (HANSEN PROPERTY)
SWMU 11 - DUST RAIL CAR LOADING AREA - NO. 2 MELT SHOP (MILE RAIL PROPERTY)
SWMU 12 - AMOCO LANDFARM (AK STEEL PROPERTY, AMOCO LEASED 1973 TO 1980)
SWMU 13 - PICKLE LIQUOR TANKS (AK STEEL PROPERTY)
SWMU 17 - WIRE MILL RINSEWATER NEUTRALIZATION TANK (AK STEEL PROPERTY)
SWMU 22 - MILL PONDS (BLUE SUMMIT PROPERTY)
SWMU 24 - WASTE HYDRAULIC AND LUBRICATING OIL STORAGE TANKS (AK STEEL PROPERTY)
SWMU 25 - ROLL SHOP DRUM STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 26 - ROD MILL DRUM STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 27 - BAR JOIST BUILDING HAZARDOUS WASTE STORAGE AREA (HANSEN PROPERTY)
SWMU 33 - NAIL MILL DEGREASING AREA (AK STEEL PROPERTY)
SWMU 34 - WASTE OIL STORAGE AREA EAST OF GST's NO. 2 MELT SHOP (MILE RAIL PROPERTY)
SWMU 35 - WASTE OIL STORAGE AREA ON NORTH SIDE OF GST's 19" MILL (MILE RAIL PROPERTY)
SWMU 36 - BALL DEPARTMENT WASTE OIL STORAGE AREA (AK STEEL PROPERTY, FORMERLY GST LEASED)
SWMU 37 - WIRE MILL WASTE OIL STORAGE AREA (AK STEEL PROPERTY)
SWMU 38 - BAR JOIST TEMPORARY GREASE STORAGE AREA (HANSEN PROPERTY)
SWMU 39 - BAR JOIST WASTE OIL AND GREASE STORAGE AREA (HANSEN PROPERTY)
AOC 1 - ABANDONED FUEL OIL STORAGE TANK (AK STEEL PROPERTY)
AOC 2 - UNDERGROUND STORAGE TANKS (USTs) (AK STEEL, MILE RAIL, HANSEN, CTE PROPERTIES, AND HOUSE OF BURGESSES LLC PROPERTIES)
AOC 4 - BOILER FURNACE AREA (AK STEEL PROPERTY)
AOC 8 - "OWL GUN CLUB" SHOOTING PARK (AK STEEL PROPERTY)

SWMUs AND AOCs NOT INCLUDED IN 1994 RCRA PART B PERMIT

SWMU 14 - ETCH LAB MIXING TANK (ONESTEEL PROPERTY)
SWMU 15 - ETCH LAB HOLDING TANK (ONESTEEL PROPERTY)
SWMU 16 - ROLL SHOP ROLL CLEANING TANK (HOUSE OF BURGESSES PROPERTY)
SWMU 18 - BLOOMING MILL SCALE PIT (AK STEEL PROPERTY)
SWMU 19 - TWELVE INCH (12") MILL SCALE PIT (AK STEEL PROPERTY)
SWMU 20 - ROD MILL SCALE PIT (HOUSE OF BURGESSES PROPERTY)
SWMU 21 - NO. 2 MELT SHOP SCALE PIT (MILE RAIL PROPERTY)
SWMU 23 - SAFETY-KLEEN UNITS
SWMU 28 - OUTSIDE HAZARDOUS WASTE STORAGE AREA
SWMU 29 - MAIN SUBSTATION PCB STORAGE AREA
SWMU 30 - LONG TRACTOR SHED PCB STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 31 - SMALL TRACTOR SHED PCB STORAGE AREA (HOUSE OF BURGESSES PROPERTY)
SWMU 32 - NO. 1 MELT SHOP PCB STORAGE AREA (AK STEEL PROPERTY)
AOC 3 - ARMCO DAM/PCB EXCAVATION AREA OF BLUE RIVER (AK STEEL PROPERTY)
AOC 5 - OUTFALL NO. 006 (AK STEEL PROPERTY)
AOC 6 - OUTFALL NO. 042 (BLUE SUMMIT PROPERTY)
AOC 7 - BACKWASH AREA OF ROCK CREEK (AK STEEL PROPERTY)

LEGEND

- ------ APPROXIMATE LIMITS OF SWMU OR AOC AREA
- BOUNDARY OF PROPERTY SOLD TO KC TERMINAL RAILROAD
- (29) OUTFALL
- LOCATION OF FORMER USTs BELONGING TO AOC 2
- AK STEEL PROPERTY
- MILE RAIL LLC PROPERTY (FORMERLY GST)
- AK STEEL PROPERTY FORMERLY LEASED TO GST
- AK STEEL PROPERTY FORMERLY LEASED TO AMOCO
- HANSEN PROPERTY DEVELOPMENT, INC. (FORMERLY GST) D.B.A. U-PICK-IT OF KANSAS CITY
- HOUSE OF BURGESSES LLC PROPERTY (FORMERLY GST) D.B.A. MIDWEST SCRAP MANAGEMENT
- CTE PROPERTIES LLC PROPERTY (FORMERLY GST) D.B.A. CUSTOM TRUCK & EQUIPMENT
- ONE STEEL GRINDING SYSTEMS LLC PROPERTY (FORMERLY GST)
- BLUE SUMMIT LLC (FORMERLY GST)

NOTES:

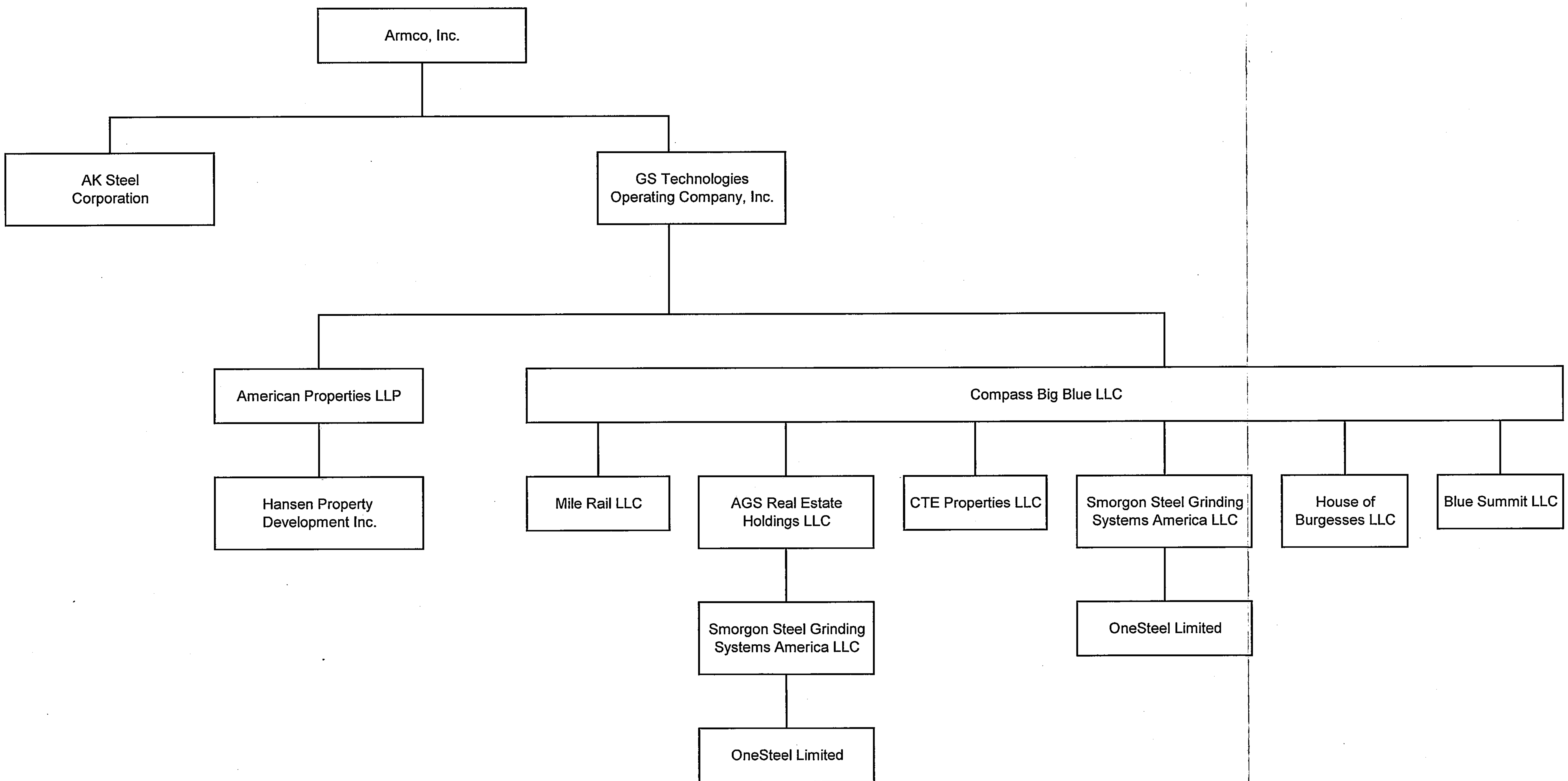
1. APPROXIMATE FACILITY BOUNDARY, AS DEFINED IN PERMIT, IS SHOWN. AS INDICATED, PORTIONS OF THE FACILITY ARE NO LONGER OWNED BY AK STEEL.
2. AREAS HISTORICALLY DECOMMISSIONED AND DEMOLISHED: NO. 1 MELT SHOP, ROD MILL, ROLL SHOP, AND NO. 2 MELT SHOP.
3. LOCATIONS OF SWMUS 23, 28, AND 29 ARE UNKNOWN.
4. LOCATIONS OF SWMUS AND AOCS NOT INCLUDED IN THE 1994 RCRA PART B PERMIT ARE APPROXIMATE AND NOT BASED ON SURVEY INFORMATION. THE LOCATIONS OF THESE SWMUS AND AOCS ARE BASED UPON FIGURE 6 OF THE RCRA FACILITY ASSESSMENT (TETRA TECH, 1992).

NORTH

500' 0' 500' 1000'
SCALE IN FEET

Burns & McDonnell

Figure 1-2
FACILITY MAP
AK STEEL KANSAS CITY FACILITY



Note: Ownership based on search of Jackson County, Missouri online public records (http://records.co.jackson.mo.us/localization/menu.asp).
Most recent Warranty Deed was dated December 9, 2010 (CBB to Mile Rail LLC). All CBB tracts have been sold.
American Grinding Systems (AGS) was sold to Smorgon Steel in October 2004, and Smorgon Steel merged with OneSteel Limited in August 2007.

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Figure 1-3

Ownership Status

AK Steel Kansas City Facility

Organizational Chart

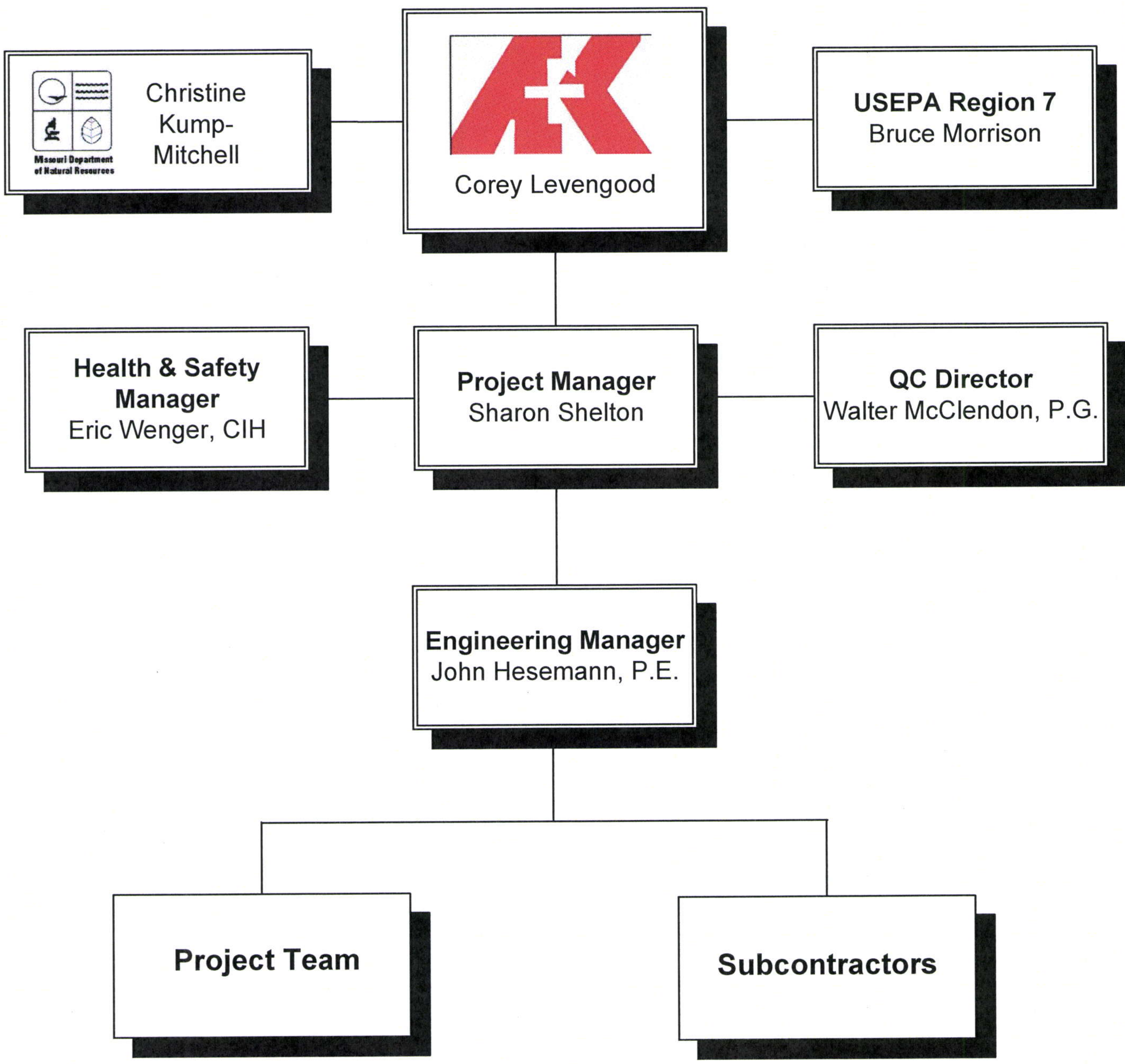

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Figure 7-1
Organizational Chart
AK Steel
Kansas City Facility